## SECTION 16010

## ELECTRICAL GENERAL PROVISIONS

### PART ONE - GENERAL

1.01 WORK INCLUDED

A. Provide a complete electrical installation consisting of electrical service, distribution, lighting system, life safety system, intercommunication/program distribution system, gymnasium sound system, cafeteria sound system, media center sound system, time out room monitor system, emergency generating system, and partial telephone, data, and video system as shown on the drawings or specified herein.

1.02 CODES

A. All electrical work under the requirements of these specifications shall be in conformance with the requirements of the current editions of the National Electrical Code, and the Occupational Safety and Health Act, and shall also be in compliance with all applicable State and/or local laws and ordinances.

1.03 DRAWINGS

A. The locations shown on the drawings are, unless dimensioned, only approximate and the Contractor shall select the actual locations for installation with due consideration for the features of the construction and the work of other trades.

B. The drawings and specifications shall both be considered as part of the Contract. Any work or material shown in one and omitted in the other, or which may fairly be implied by both or either, shall be provided in order to give a complete job.

C. Refer to the Architectural, Structural and Mechanical plans and details for dimensions, and fit the work to conform to the details of building construction. The right is reserved to shift any switch, receptacle, ceiling outlet or any special outlet a maximum of 10'-0" from its location as shown before it is permanently installed, without incurring additions to the Contract.

D. All conduit and wiring shown on the electrical drawings shall be provided under this Division regardless of its function.

E. No deviations from the drawings and specifications shall be made. If it is found that existing conditions make desirable a modification in requirements covering any particular item, report such item to the Architect for his decision and instructions.

F. All manufacturers listed on drawings and in specifications are for design purposes only and shall not be used for sole specification.

1.04 COORDINATING WITH OTHER DIVISIONS

A. Motors will, unless noted otherwise, be furnished with the equipment they drive.

B. Power wiring and connections for all heating, ventilating and air conditioning equipment shall be furnished under this division.

C. Controllers and interlock wiring, including conduit, wire and connections for all heating,

ventilating and air conditioning equipment shall be furnished under other divisions of the specifications as indicated on the drawings.

D. Disconnect switches, where not furnished with equipment, will be furnished and mounted under this division of the specifications as indicated on the drawings.

E. Control connections for 120 volt exhaust fans will be furnished under this division.

F. Before any piping, conduit, outlets, equipment or lighting fixtures are located in any area, coordinate the space requirements of all trades. Such shall be arranged so that space conditions will allow all trades to install their work, and will also permit access for future maintenance and repair.

G. Piping, ductwork, conduit and equipment installed at variance with the above requirements shall be relocated and/or revised to conform at the expense of the Contractor and without incurring additions to the Contract.

H. Coordination of space requirements with all trades shall be performed so that:

1. No piping or ductwork other than electrical, shall be run within 42" of panelboards, switchboards or transformers.
2. No pipes or ducts that operate at a temperature in excess of 120 degree F. shall be installed nearer than 3" to any electrical conductor.

1.05 ADJUSTING AND TESTING

A. All electrical equipment furnished under this contract including the electrical equipment furnished under other sections shall be tested for proper operation by the Contractor under this section. Protective devices shall be examined for proper rating and application and adjusted as necessary. Completed wiring systems shall be free of short circuits.

B. Test all systems described in this Division in the presence of the Owner or a designated representative upon completion of the work. Demonstrate that the installation is in accordance with Contract Documents.

C. Provide to the Owner all instructions on maintenance and operation of all systems and equipment provided. Provide all necessary tools and personnel to thoroughly demonstrate and present those instructions.

D. The Contractor shall uncover all concealed areas during inspections if requested.

1.06 UTILITY SERVICE AND LOCATION

A. The Contractor shall notify the "free underground utility location service" at 1-800-282-7411 and the Owner's Construction manager before any excavations are begun. Contractor may request that WCPS maintenance personnel locate all underground utilities (on Owner's side of meter) prior to excavations. However, all scheduling of maintenance personnel shall be done through the Owner's Construction Manager. Upon completion of locating undergroun utilities, the Contractor shall be responsible for recording and maintaining these locations on the record drawings for future reference for duration of project.

1.07 CERTIFICATES OF APPROVAL

A. All necessary permits, inspection fees and licenses shall be obtained and paid for by the Contractor.

B. At the completion of the building, the Contractor shall furnish and deliver to the Owner, Certificates of Approval from the local inspecting authority for the National Board of Fire Underwriters and other agencies having authority, indicating approval of the electrical work installed under the contract.

1.08 SHOP DRAWINGS

A. Shop drawings and/or catalog data on all items of equipment and materials shall be submitted in conformity with requirements of the General and Supplementary Conditions. The responsibility of complying with the Contract Documents shall not be relieved by the Engineer's review of shop drawings.

B. The submittal shall include a list of the manufacturers of the principal items of material: wire, conduit, connectors, devices, boxes, lighting fixtures, special systems, panelboards, switchboards, etc.

C. Specified catalog numbers and trade names are intended to describe the material, devices, or apparatus desired. Similar materials of other manufacturers, if of equal or equivalent quality, capacity and character may be substituted in conformity with provisions of the General and Supplementary Conditions.

D. Samples of all materials proposed for use shall be presented to the Architect for his approval when requested.

1.09 ELECTRICAL SERVICES TO EQUIPMENT

A. Following equipment shall be furnished and installed under other Sections of this manual:

| | | |
|---|---|---|
| 1. | Finishing Hardware | Section 08700 |
| 2. | Projection Screens | Section 11300 |
| 3. | Special Equipment | Section 11300 |
| 4. | Food Service Equipment | Section 11450 |
| 5. | Casework | Section 12300 |
| 6. | HVAC Equipment | Section 15060 & 15600 |
| 7. | Water Heaters | Section 15400 |
| 8. | Automatic Controls | Section 15275 |

B. Contractor shall coordinate and determine the electrical requirements of all equipment (whether included in above list or not) furnished under other Sections.

C. Contractor shall provide power wiring, conduit, disconnect switches, junction boxes as may be required for equipment furnished under other sections of this specification. Make all final hook-ups and connections.

D. Contractor shall carefully review all portions of the documents, so as to become aware of the scope of the work required by this section.

1.10 MATERIAL, WORKMANSHIP, AND PROTECTION

A. Material and apparatus of the latest and best design and manufacture shall be installed to provide complete electrical systems. Experienced mechanics of proper trades shall perform work and work harmoniously with all other trades. All work, material, fixtures, apparatus, etc., shall be protected from injury or damage and delivered clean. All cutting and channeling shall be accomplished in a neat and workmanlike manner without removal of excess materials. Patch and replace all cut and channeled areas with material similar to adjacent construction.

B. Unless noted otherwise, all material shall be new and shall bear the inspection label of Underwriters' Laboratories, Inc. (UL).

C. The published standards and requirements of the National Electrical Manufacturers Association, the American National Standards Institute, the Institute of Electrical and Electronic Engineers and the American Society of Testing Materials shall apply where applicable.

1.11 GUARANTEE

A. Defects due to faulty material, workmanship or design which develop within one year from date of final acceptance are to be properly remedied, replaced and made good without cost to the Owner.

**END OF SECTION 16010**

## SECTION 16100

## BASIC MATERIALS AND METHODS

### PART ONE - GENERAL

1.01 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 16010.

B. This Section covers the basic electrical materials and methods that are applicable to all sections of Division 16.

C. Material furnished for inclusion in the work shall have been designed, built and tested in accordance with applicable NEMA and IEEE standards, shall be approved and labeled by the Underwriters' Laboratories, Inc. and shall be new, unless otherwise noted.

D. All material and equipment shall be installed in accordance with manufacturer's recommendations.

### PART TWO - PRODUCTS

2.01 CONDUIT AND RACEWAYS

A. Rigid steel conduit shall be low carbon, hot-dipped galvanized both inside and out with threaded joints.

B. Intermediate metal conduit (IMC) shall be steel, galvanized both inside and out with threaded joints.

C. Electrical metallic tubing (EMT) shall be steel, galvanized both inside and out.

D. Flexible conduit shall be flexible steel conduit tubing and shall meet Underwriters' Laboratories Standard for Flexible Steel Conduit.

E. Steel conduit approved manufacturers are Allied, Southwire, Triangle, Republic, Wheatland and Pittsburgh.

F. PVC conduit shall be Schedule 40 polyvinyl chloride, conforming to UL65.

2.02 CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings shall be zinc-coated, ferrous metal and threaded type.

B. EMT fittings shall be zinc-coated hex-nut compression. EMT connectors shall have insulated throats. Die-cast fittings will not be allowed. Set screw type connectors or couplings will not be allowed.

C. Conduit connections to panel cabinets and pull boxes shall have grounding wedge lugs between the busing and the box or locknuts designed to bite into the metal.

D. Each end of each conduit shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

E. Where hubs or water-tight threaded connections are not provided as a part of the enclosure and are required, water-tight hubs similar and equal to Myers "Scru-Tite" hubs shall be installed.

F. Junction boxes shall be of code gauge metal with continuously welded joints or of cast metal as called for on the drawings. All junction boxes shall be gasketed screw cover boxes.

G. Pull fittings shall be type "LB", "C", and "TB" condulet fittings on individual conduits where conductor size does not exceed #2 AWG for 600 volt insulation. O.Z. Mfg. Co. type "PBW", Appleton Electric Co. type "PTC", or approved equal, pull box fittings of the proper length for the size conduit involved and the size and type of conductors contained, shall be used in all other cases unless otherwise noted on the drawings.

H. Conduit fittings approved manufacturers are Raco, Steel City, O.Z., Thomas & Betts, Efcor and Appleton.

I. Expansion fittings shall be provided in all conduit which crosses an expansion joint.

2.03 CONDUCTORS

A. Conductors shall be copper of 98% conductivity, 600 volt, "THHN", "THHW" or "XHHW" insulation. Sizes specified are AWG gauge for No. 4/0 and smaller and circular mils (MCM) for all sizes larger than No. 4/0. Conductors No. 10 and smaller shall be solid; No. 8 and larger shall be stranded.

B. Copper conductor approved manufacturers are Anaconda, General Cable, General Electric, Hatfield, Paranite, Phelps-Dodge, Reynolds, Simplex, Diamond, Rome and Southwire.

2.04 OUTLETS

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specific usage, location, size and quantity of conduit, and size and quantity of conductors entering the boxes. In special "Fire Rated" partitions, outlets shall comply with ASTM No. E119.

B. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be 4" square or octagonal pressed steel boxes. Boxes for devices in unfinished masonry walls or stud walls shall be pressed steel square corner, sectional switch boxes, or shall be 4" square box with a square cornered tile wall cover, set flush with masonry construction. Boxes in concrete ceiling slabs shall be octagonal, shallow pressed steel concrete boxes. Boxes exposed shall be cast type.

C. All outlet boxes in plaster walls or ceilings shall be provided with plaster rings.

D. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

E. Outlet box approved manufacturers are Appleton, Raco, Steel City and Crouse-Hinds.

2.05 DISCONNECT SWITCHES

A. Disconnect switches shall be "heavy-duty" type enclosed switches of quick-make, quick-break construction. Switches shall be horsepower rated for 600 volts AC as required. Lugs shall be UL listed for copper and aluminum cable.

B. Padlocking provisions shall be provided for padlocking in the "off" position.

C. Switches shall be furnished in NEMA 1 general purpose enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures.

D. Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

E. Manual motor controllers for single phase, fractional horsepower motors shall be single or two pole as required, and for the proper voltage. Each shall have one thermal overload device and shall be General Electric RR101Y or CR101H, or approved equal.

F. Safety switches shall be as manufactured by General Electric, or approved equal by ITE, Square-D, Westinghouse or Cutler Hammer and shall match switchgear choice.

2.06 WIRING DEVICES

A. Wall switches shall be bakelite phenolic, totally enclosed, quiet type, self-grounding, 120/277 volts and 20A rating.

| | |
|---|---|
| Single Pole: | Hubbell No. 1221 P & S No. 20AC1 Leviton No. 1221 |
| Double Pole: | Hubbell No. 1222 P & S No. 20AC2 Leviton No. 1222 |
| Three-Way: | Hubbell No. 1223 P & S No. 20AC3 Leviton No. 1223 |
| Four-Way: | Hubbell No. 1224 P & S No. 20AC4 Leviton No. 1224 |

B. Color shall be Grey.

C. Flush motor switches with red pilot light and with overload protection for fractional horsepower motors shall be Square "D" type FSJ-1P or approved equal. (These switches should be key type.)

D. Key switches in corridors, cafeteria, high school gyms and gang toilets shall be P & S 20 AC Series or approved equal by Hubbell or Leviton. Elementary school activity buildings shall have a toggle switch with a guard for lighting control with a separate toggle switch inside the door for the exterior wall pack.

E. Convenience outlets shall be 3 wire grounding type rated 20 amperes at 125 volts A.C. or D.C. Duplex receptacles shall be Harvey-Hubbell, Inc. No. 5252, or approved equal. Color shall be as follows:

| | |
|---|---|
| Normal receptacles | Grey |
| Dedicated Computer Receptacles | Orange |
| Emergency Receptacles | Red |

F. Coverplates for flush mounted devices shall be brushed finished stainless steel jumbo size. P & S Sierra SO Series.

G. Telephone and data and special outlet coverplates shall have same finish as above and have a bushed hole in the center.

H. Coverplates for exterior devices shall be self closing, die cast aluminum P & S Sierra WP Series.

I. All device plates for receptacles shall be engraved with panel designation, and circuit number in 1/4" high black lettering.

J. Special outlets shall be as indicated on the drawings.

K. Comparative wiring devices by Leviton, Hubble and P & S are acceptable.

2.07 PANELBOARDS

A. Panelboards for lighting and appliance circuits shall be of the dead-front type with bolt-on type molded case circuit breaker branches. Details of construction including service voltage, number and rating of branches, size of mains, and whether surface or flush mounting are indicated on the drawings. 277/480 volt panelboards shall be Square-D type NEHB with breakers rated 14,000 RMS Sym. amps. 120/208 volt panelboards shall be Square-D type NQOB with breakers rated 10,000 RMS Sym. amps. Multi-pole breakers shall be a common trip (breaker tie handles not permitted). Provide directory frame on door with typewritten card listing circuit numbers and designations. All buswork shall be copper.

B. Fused distribution panelboards where indicated on the drawings shall be Type II, Class 1, U.L. listed. They shall be listed and labeled for Service Entrance equipment where drawings indicate this use. Integrated equipment short circuit rating shall be 200,000 max. RMS sym. amps with appropriately rated current limiting fuses. Branch switches shall be as indicated on the drawings with current limiting fuses. Panelboards shall be Square-D type QMB.

C. Comparative panelboards by Square-D, Westinghouse, Cutler Hammer, General Electric, or Siemens-Allis-ITE are acceptable, but must match switchgear choice.

2.08 SWITCHBOARD

A. Switchboard shall be a completely self-supporting structure labeled for service entrance of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard 90" high. The sides, top, and rear shall be covered with removable screw-on code gauge steel plates. Switchboard shall include all protective devices and equipment as listed on the drawings with necessary inter-connections. Buses shall be tin-plated aluminum sizes on the basis of no more than 800 amperes per square inch current density. The bus bars shall be mounted on supports of high impact non-tracking insulated material, and shall be braced to withstand available mechanical forces exerted during short circuit conditions when connected directly to a power course having the indicated short-circuit current.

B. All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film. The switchboard exterior shall be finished in manufacturer's standard grey. All hardware used on conductors shall have a high tensile strength, and have a suitable protective finish.

C. A ground bus shall be furnished secured to each vertical section structure, and shall extend the entire length of the switchboard.

D. Switchboard shall be provided with adequate lifting means, and shall be capable of being rolled or moved into installation position, and bolted directly to the floor without use of floor sills.

E. A-B-C type bus arrange--left to right, top to bottom, and front to rear shall be used throughout to assure convenience and safe testing and maintenance.

F. Record drawings shall be furnished providing the following information: Complete rating, short-circuit with- standability of bus and of lowest rated device, overall outline dimensions,

including space available for conduits, circuit schedule showing circuit number, device description, device frame ampere rating, trip or fuse slip ampere rating, feeder circuit identification, conductor ratings, and one-line diagram with each circuit device numbered.

G. Switchboard shall be NEMA Class I construction. The main and distribution sections shall be not more than 24" in depth. All sections of the switchboard shall be rear aligned so that the completed structure may be placed against the wall. The distribution branch protective devices shall be group mounted with necessary bar connection straps, and having the device (line and load) connection accessible from the front. Where space for future is called for, all necessary buses except device connecting straps shall be furnished. Provide engraved laminated nameplates identifying all switches.

H. Provide full height wiring gutter doors for quick access to working terminals.

I. Contractor shall ensure that switchboard as submitted will fit in available space.

J. Acceptable manufacturers are Square-D, Westinghouse, General Electric, Siemens-ITE or Cutler-Hammer.

2.09 TRANSFORMERS

A. Small dry type transformers to provide power for lighting, convenience outlets, heating, etc. shall be wall or platform mounted, and shall have NEMA Standard taps. Primary and secondary voltages, phases, and transformer ratings shall be as indicated on the drawings. Sizes 25 KVA and smaller shall be totally enclosed, and Underwriters Laboratories listed for indoor or outdoor installation. Sound levels shall not exceed those listed by NEMA-ANSI Standards for general purpose transformers and is no case more than 45 db.

B. All dry type transformers shall have an insulation system with a maximum temperature rating of 220° C and a basic impulse level of 10 kV. All transformers shall be designed to produce rated output with an average conductor temperature rise of 80° in a 40° C ambient temperature. All transformers shall be furnished with four primary voltage taps: Two 2-1/2% above, and Two 2-1/2% below rated voltage. All dry type transformers shall be of General Electric, Sorgel Electric Corporation, Westinghouse Electric Corporation, Acme, Cutler Hammer, Jefferson or ITE.

C. All dry type transformers 5 kVA and larger shall be floor mounted and located inside building.

D. Vibration/Isolation pads shall be used for all transformers.

2.10 PLYWOOD BACKBOARDS

A. Provide Grade A-C plywood backboards where shown. Backboards shall be fire treated and shall be minimum 3/4" thick and sizes as shown or to accommodate equipment indicated to be mounted thereon with some additional space remaining for future use.

B. Paint both sides and all edges with two coats of flat grey fire resistant paint. Prior to installation, then secure plywood to the building structure.

2.11 SMOKE AND FIRE STOP FITTINGS

A. Smoke and fire stop fittings shall be U.L. listed for that purpose. The fittings used to seal conduit either on the outside of the conduit or internally shall have heat activated intumescent material which expands to fill all voids and shall be O.A./Gedney "FIRE-SEAL" or approved

equal with an hourly fire-rating equal to or higher than the rating of the floor or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type.

2.12 TIME CLOCKS

A. All time clocks shall be 7-day clocks with 24 hour carry-over, Paragon # 7217-00 in NEMA 1 enclosure or approved equal.

## PART THREE - EXECUTION

3.01 CONDUIT

A. Rigid steel or IMC shall be used for feeders, branch circuits in concrete and for feeders and branch circuits where exposed to damage and exposed less than 6' above finished floor.

B. EMT shall be used for branch circuits, fire alarm, data /voice, and video.

C. Plastic conduit may be installed for underground service into building from Power Company transformer to Main Service and for exterior runs for site lighting. A plastic to rigid steel or intermediate metal conduit to rise above grade. Provide green equipment grounding conductors in all plastic conduits.

D. Conduits shall be supported on not more than 8'-0" centers when concealed and 5'-0" centers when exposed. Conduits shall be supported by means of approved galvanized iron clamps or hangers, attached to masonry with inserts and bolts or lead expansion shields or to structural members by means of approved galvanized iron clamps or hangers. Where installed exposed, conduits shall be parallel with or at right angles to walls or ceilings.

E. All conduit installed in or under the building floor slab shall be galvanized rigid or intermediate steel conduit or PVC where allowed by code. Conduits in the concrete floor slabs on grade shall be installed inside the slab above the vapor barrier where possible and shall be covered with a minimum of 2" of concrete bottom. If metallic conduits are installed below the floor slab and vapor barrier they shall be coated with two coats of coal tar bitumastic equal to Koppers Bitumastic 505.

F. Conduit underground outside the building shall be rigid steel conduit or PVC where allowed by code. Metallic conduits shall be coated with two coats of coal tar bitumastic equal to Koppers Bitumastic 505. Conduits containing conductors at voltages of 120 volts or higher (phase to ground) shall be installed a minimum of 48" below grade. Electrical cable may be direct burial where code allows. All underground wires or conduits shall be buried with a warning tape installed 24" above the conduit or cable.

G. Warning tapes shall be T & B/Westline NA-1268 (yellow) for electric lines, NA-1270 (green) for telephone or cable TV lines and NA-1274 (yellow) for high voltage primary by Power Company.

H. Conduit shall be secured independently of other conduit.

I. Conduits shall be rigidly secured to structure in vertical and horizontal planes with exception of in slab or in earth which will be run in the nearest and most direct method.

J. All conduits left for future use and for special systems shall be left with a 70# test nylon cord pulled in them and the ends corked or capped. Both ends of conduit shall be clearly identified as to where the other end is terminated.

K. Connectors and couplings on rigid steel and intermediate metal conduit shall be threaded. Where rigid steel or intermediate metal conduit is connected to a hubless box, a locknut shall be used on each side of the box wall. If threadless connectors are used on RGSC or IMC, a ground wire must be installed inside the conduit and sized according to circuit or feeder size.

L. Where power and lighting conduits are laid below ground, they shall be rigid galvanized steel or intermediate metal or PVC where allowed by code and encased in 4 inches of 2500 P.S.I. concrete on all sides, unless noted otherwise.

M. Non-metallic conduit shall be Schedule 40, 90° Centigrade, rated polyvinyl chloride, Underwriters' Laboratories listed for underground direct burial. All PVC shall contain an insulated grounding conductor of the correct size per N.E.C.

N. All vertical conduit runs not supported by walls are to be secured at floor and ceiling. Conduits are to be secured at the floor by means of a flange secured to the floor by expansion bolts. Connections to the equipment are to be by means of a "tee" conduit fitting and flexible conduit.

O. Conduit seal off fittings shall be used on all conduits that go from refrigerated areas into a non-refrigerated area, or from a hazardous area to a non-hazardous area and on all conduits to sewage lift pumps or other

D. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc. in such a manner that each system will be electrically continuous from service to all outlets. All conduit from cabinets and junction boxes shall terminate in approved outlet boxes or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknutted.

E. Provide junction boxes or pull boxes where shown and where necessary to avoid excessive runs or too many bends between outlets. The conduit sizes shown may be increased if desired to facilitate the pulling of cables.

F. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized iron clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed high enough to permit removal of ceiling panels and lighting fixtures. Use threaded rods and hangers for supporting single conduit. Use trapeze hangers consisting of double-nutted threaded rods and "Unistrut" channels or angles of 12 gauge minimum steel for supporting multiple conduit.

G. Minimum size conduit for branch circuits shall not be smaller than ½". Home runs shall extend from outlets shown to panel designated. Home runs shown may be combined where running to the same panelboard. Limit maximum number of home runs per conduit to three (3).

H. At couplings, conduit ends shall be threaded so that they meet in the coupling. Right and left hand couplings shall not be used; conduit couplings of the Erickson type shall be used at locations requiring such joints.

I. Expansion fittings shall be installed in all conduit which pass through expansion joints.

J. Provide non-hardening elastic type duct seal compound, Neer No. DC, 3M Co. "Scotchfil", or Gardner Bender duct seal, for each conduit entering the building from outside and for each conduit passing from one space into another which is normally at a lower temperature.

K. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with a fire resistive material that will maintain the rating of the barrier penetrated.

3.02 FLEXIBLE CONDUIT

A. Flexible conduits shall be galvanized steel or aluminum. All flexible conduits shall be installed with a green ground wire run inside the conduit from box to box; or in the case of no box, the ground wire shall be run on the outside of the flex.

B. Connections to equipment in mechanical rooms, kitchens and other places as noted shall be made with water tight, jacketed, flexible conduit. Flexible conduit shall be no longer than necessary, and in no case longer than six (6) feet, nor less than eighteen (18) inches.

C. Furnish and install flexible metal conduit connections to all motors and to all equipment subjected to vibration. Minimum size shall be ½ inch. Length shall be approximately 15 inch minimum and shall not exceed 6'0" maximum.

D. Nominal size ½" flexible metal conduit in lengths not exceeding 6'0" may be used for connecting lighting fixtures. (Single fixtures- not rows.)

E. Provide "Sealtight" conduit and Appleton, Ideal or T & B liquid-tight fittings at all flexible connections subject to weather. All flexible conduit shall contain a green grounding conductor. (Flexible conduit may not be used as a grounding conductor.)

F. No flexible conduit is to penetrate any wall.

G. Conduit runs shall not be coupled with flexible conduit without a junction box, and then only for hook-up of vibrating or appliance connections. Exception: dry type transformers.

H. Any conduit or flex exposed on interior or exterior which is accessible from finished grade or floor surface is subject to physical abuse and must be installed in such a manner so as to limit this installation from becoming a safety hazard in the future. Special attention is directed to thru wall heat pump and bard units.

I. A green stranded bonding jumper shall be installed outside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine. When the bonding jumper is installed outside of the flexible conduit, plastic wire straps shall be used 6" o.c. to secure the jumper to the flexible conduit.

3.03 CONDUIT PROTECTION

A. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged to avoid filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.

3.04 WIRING

A. All conductors shall be installed in conduit, unless otherwise noted. No conductors shall be pulled into the conduit until the conduit system is complete and plaster as dried. Only U.L. listed lubricants shall be used in pulling conductors.

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with pressure type connectors, "SKOTCHLOK" or approved equal. Tape shall be "Scotch" No. 33 for indoor and No. 88 for outdoor or approved equal. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be bolted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.

C. Each conduit shall have a minimum of two (2) conductors pulled in unless that particular conduit is noted as being empty for future use. The number of cross hatches indicates the number of conductors to be installed when the number exceeds the minimum of two (2). This does not apply to conduit installed for telephones and other special systems.

D. Conductors for lighting and receptacles circuits up to and including # 8 shall have color coded jackets. All conductors from # 6 and up are to be color coded with tape within two (2) inches of each end to indicate voltage and phase. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

| 208/120 VOLT SYSTEM | 480/277 VOLT SYSTEM |
|---|---|
| Phase A - Black | Phase A - Brown |
| Phase B - Red | Phase B - Orange |
| Phase C - Blue | Phase C - Yellow |
| Neutral - White | Neutral - Gray |
| Ground - Green | Ground - Green |

E. The feeder and service entrance conductors shall be color coded by the use of colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from center of load exceeds 75'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. Branch circuit wiring which supplies more than one (1) fluorescent fixture through wireway of other fixtures shall be rated for use at 105 degree C.

H. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire with taped ends and coiled for connection of equipment. All conductors shall be identified with proper circuit numbers at terminals and junction boxes.

I. The wiring for intercom and fire alarm for new adjacent buildings should tie back to the corresponding system in the main classroom building by separate homeruns to fire alarm panel, not by connecting to nearest fire horn or pull box. All new wiring shall be identified by number.

J. Intercom/fire alarm stub-outs (weatherhead through roof) shall be provided to accommodate possible future portable classrooms. Coordinate location with Owner.

K. Branch circuits shall be 2, 3 or 4 wires run from the panels to all outlets. In no case shall designated homeruns be combined with other homeruns.

L. Where wiring is relocated from one cabinet to another, the complete circuit and conduit shall be rerouted to the new location and not pass through the original cabinet.

M. Where a portion of a circuit, feeder or system is interrupted, the existing portions shall be rerouted and reconnected together to maintain the original integrity.

N. No splices are allowed in panels.

O. All junction boxes are to have 8 inches of slack for future use as opposed to having wires pulled right through boxes.

P. All wiring that extends within fluorescent fixtures that is over 12 inches long shall be 105 degree Centrigrade type THHN or THWN.

Q. All wiring within flexible conduit shall be flexible stranded.

R. All neutral branch wires shall be white or grey depending on voltage, and all other wires shall be color coded. All grounding conductors #8 or smaller shall have green insulation. Grounding conductors #6 or larger shall be identified with green tape.

S. Stub-outs shall be provided for intrusion alarm in all new construction. Coordinate location with Owner.

T. Plenum rated cable may be used for low voltage installations using loop hangers properly secured above ceilings. Plenum rated cable shall be color coded as follows:

| | | |
|---|---|---|
| 1. | Intercom | Blue tint |
| 2. | Fire Alarm | Red tint |
| 3. | TV | Black tint (grey) |
| 4. | DDC | White (standard, furnished under mechanical) |
| 5. | Data | Orange (furnished and installed by Owner) |

3.05 OUTLETS

A. Provide galvanized steel or cast type boxes for all outlets.

B. Where outlet boxes are used to support lighting fixtures, the outlet box shall be anchored to the structural members of the building.

C. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

D. Where outlets are supplied from conduit in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

E. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architect's approval, so that the outlet box, top or bottom, will occur at a masonry joint.

F. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the cover plate is installed and the cover plate shall not be used as a means of tightening the device in place.

G. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the center line of the group.

H. Support each box independently from the building structure independent of conduit.

I. Locate boxes and condulet bodies so that covers are accessible and removable.

J. All boxes shall be equipped with coverplates of the correct type and size for the type of box and all screws shall match plate finish.

K. Receptacle boxes on science table tops are to be bolted to support and not solely dependent on a nipple for support.

L. Outlet boxes shall be set so that the front edge is flush with the finished face of the wall.

3.06 NAMEPLATES

A. Provide engraved laminated white core nameplates on the main switchboard, feeder switches, feeder breakers, distribution panels, panelboards, disconnect switches, contactors, starters, time switches, start-stop push buttons and motor switches that do not have one.

B. Nameplates for surface mounted equipment shall be installed on the exterior of equipment with sheet metal screws. Nameplates for flush or recessed mounted equipment shall be installed on the inside of the panel door or cover with epoxy cement.

C. Nameplates shall have 3/8" high engraved letters.

D. 120 or 208 volts: white core laminated bakelite with black finish.

E. 277 or 480 or high volts: white core laminated bakelite with red finish.

3.07 WALL SWITCHES AND RECEPTACLES

A. Where more than one device is indicated at a location, the devices shall be mounted in combined sectional gang boxes and covered jointly by a common coverplate.

B. Locations of outlets shown on the drawings are relative and approximate unless noted otherwise. Exact locations shall be determined on the job and the outlets accurately set according to architectural drawings, dimensions and Architect's direction.

C. Mount switches vertically with up being the "on" position.

D. Back to back receptacles shall be offset a minimum of 24" o.c. (No thru-wall boxes shall be used).

E. All kitchen/cafeteria serving line equipment shall have the electrical service fed from overhead.

F. Ground fault receptacles shall be used in wet areas and at all sink locations.

G. All receptacles shall be grounded with a green ground wire connected form the ground lug on the receptacle to a screw in the back of the outlet box or with an approved grounding strap.

H. Receptacles shall be secured to the outlet box without depending on the cover to pull them tight.

I. Mount devices vertically, unless noted otherwise.

J. Mount receptacles occurring over countertops horizontally.

K. Duplex electrical outlet shall be installed within 16" on center of the TV outlet.

3.08 COVERPLATES

A. All junction boxes, outlet boxes, sectional switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

3.09 SAFETY SWITCHES/DISCONNECT SWITCHES

A. All equipment utilizing gas and/or electricity is to have a disconnecting means within six (6) feet of equipment or within reach of equipment served. (Cord and plug on 1 Ø 120V-208V is acceptable.) Special attention is hereby brought to kitchen equipment (disconnect should also be external and not a factory part of appliance).

B. Provide support channel frame for mounting when wall mounting is not available. Avoid mounting directly on equipment housing.

C. All equipment power of 2 KVA and higher to have a disconnect (N.E.C.) within six (6) feet of equipment or within reach of equipment and must contain a can ground lug with a marked ground wire of proper size. All disconnects shall be mounted vertical.

3.10 PANELBOARDS

A. Electrical panel for kitchen equipment shall be directly accessible in kitchen.

B. Provide a typewritten directory under plastic for all panelboards with spares marked in pencil.

C. Clean enclosure of all switchgear of all foreign matter, including dust.

D. Flush panelboards shall have a minimum of three 3/4 inch empty conduits turned out of the wall above the ceiling for spares.

E. All panel branch circuits shall be of the sequence, vertically number, distributed phase type. (Numbers 1, 2 and 3 shall be phase A, B, and C.) Panel buses shall be numbered and circuit numbers shall correspond to space numbers in panel.

F. All panel covers in a building are to be keyed alike.

G. Where two panels of different height are used, the tops shall be the same height A.F.F., and in no case should exceed 6'-6". Double width panels shall have matching trims and both cabinets and doors shall be the same size.

H. All circuits shall be identified in detail, identifying what is served by each circuit. Spares shall be noted in pencil. Spaces are to be numbered from top to bottom starting on the left side.

3.11 GROUNDING

A. Ground connections shall be in accordance with the National Electrical Code requirements.

B. Provide an insulated green bonding jumper from the metal housing of wall mounted or suspended light fixtures to the grounded outlet.

C. Common Grounding Electrode System

1. Bond together each of the following to each main service ground bus with a #3/0 green insulated "XHHW" copper ground conductor in a 1" PVC conduit to provide a common grounding electrode system.
   a. Underground main metallic water pipe, connect ahead of the first valve, provide a bonding jumper across water meter.
   b. Structural steel building frame, connect to nearest vertical member originating at a footing.
   c. Concrete encased electrode consisting of 20 feet of #4 AWG bare copper conductor encased in a footing or foundation in direct contact with the earth.
   d. A made electrode consisting of three 10-foot copper clad ground rods spaced 12 feet apart in the form of an equilateral triangle and bonded together to form a loop. The entire rod assembly shall be installed a minimum of 24" below finished grade and the connections on the triangle shall be cad-welded to the rods.

3.12 BONDING

A. Bond the following conduits to each other, the housing can and ground bus with a #3/0 insulated copper ground wire and grounding bushings.

1. All conduits entering any free standing enclosure, transformers or other equipment.
2. All conduits entering main service device.

B. Bond together all non-current carrying metallic parts to provide continuous grounded path for all devices, equipment and enclosures.

C. Bond all receptacles, switches and other wiring devices by providing and 8" long green insulated copper ground conductor from device grounding lug to the metallic box or the branch circuit grounding conductor.

D. Bond all items connected by flexible type conduits by providing a green insulated copper ground conductor installed in the conduit and bonded to the enclosure or ground bus at each end.

E. Install an insulated bond wire in all conduits which supply power to any microprocessor controlled equipment. Bond shall originate at power source and end at appropriate equipment bond point.

3.13 CONNECTION TO EQUIPMENT

A. Equipment furnished by the Owner or under other Sections, such as Mechanical Equipment, Elevators, Escalators, Signs, Kitchen Equipment, etc. will be installed by others. Provide electrical service and make the electrical circuit connections to this equipment as directed.

B. Service shall be provided for all equipment requiring same, whether furnished in Contract or furnished by others. Provide service for and connect the following equipment.

1. All food service equipment.
2. Fume hoods and other equipment in labs, shops, etc.
3. Hand dryers (two in each toilet room) in elementary, middle, and high school student gang toilets.
4. Electrically operated theater divider partitions.
5. Electrically operated projection screens (2) in high school theater building.
6. Basketball backstops (high schools).
7. Oscillating fans in kitchen (coordinate with mechanical).
8. Art room kiln and exhaust hoods.

9. Door hold-open devices.
10. Water heaters.

3.14 MOUNTING HEIGHTS

A. Unless otherwise directed, heights above floor to top of device shall be as follows:

| | |
|---|---|
| Lighting Switch | 4'4" |
| Receptacle- General | 1'8" |
| TV Antenna Outlets | 5'6" |
| Panelboards | 6'8" |
| Safety Switches | 6'0" |
| Motor Starters | 6'0" |
| Thermostats (horizontal) | 5'6" |
| Fire Alarm Pull Station | 5'0" |
| Fire Alarm Horn | 7'8" |
| Clock Outlets | 7'8" |
| Program Bells | 7'8" |
| Hand Dryers (See Section 108010) | |
| Call Back Intercom System | 4'6" |
| TV Electrical Outlet | 5'6" |

3.15 EQUIPMENT SUPPORTS

A. The Contractor shall furnish and install all necessary supports for mounting electrical apparatus. All structural shapes, rods, bolts, nuts, etc., used to support electrical equipment shall be galvanized.

3.16 PAINTING

A. Except as specified herein, painting will be done as described in other divisions of the specifications, but the electrical installation shall be free of rust, dirt, grease, and other foreign material.

B. Equipment with a factory applied finish shall have scratches, chips, etc., repaired and refinished to the satisfaction of the Architect.

3.17 CUTTING AND PATCHING

A. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the concrete voids around the sleeves.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

**END OF SECTION 16100**

## SECTION 16112

## EMERGENCY/STANDBY POWER SYSTEMS GENERATOR SET(S)

### PART ONE – GENERAL

1.01 SCOPE

A. Provide complete factory assembled generator set equipment with digital electronic controls.

B. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.02 CODES AND STANDARDS

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
2. NFPA37 –
3. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
4. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the following standards:

1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
2. UL1236 – Battery Chargers
3. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

C. The control system for the generator set shall comply with the following requirements.

1. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
2. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
3. FCC Part 15, Subpart B.

4. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
5. UL1236 –Battery Chargers.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 ACCEPTABLE MANUFACTURERS

Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based generator sets manufactured by Cummins Onan, Generac or Caterpillar. Equipment by other suppliers that meet the requirement of this specification is acceptable, if approved not less than 2 weeks before scheduled bid date. Proposals must include a line by line compliance statement based on this specification.

## PART TWO – PRODUCTS

2.01 GENERATOR SET

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: 277/480 Volts AC, Three phase, 4-wire, 60 hertz.
2. The generator set shall be rated as indicated on the drawings: Altitude 1000 ft. ambient temperatures up to 104 degrees F.
3. The generator set rating shall be based on emergency/standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 368 kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails

2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.02 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be natural gas fueled, radiator and fan cooled. Minimum displacement shall be 412.5 cubic inches, with 10 cylinders. The horsepower rating of the engine at it's minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Engine accessories and features shall include:

B. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set. For dual fuel systems, changeover from primary to secondary fuel shall be automatic.

C. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

D. Skid-mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured 3 feet from the generator air inlet, based on 0.5 in $H_2O$ external static head. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.

E. Electric starter(s) capable of three complete cranking cycles without overheating.

F. Positive displacement, mechanical, full pressure, lubrication oil pump.

G. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

H. Replaceable dry element air cleaner with restriction indicator.

I. Flexible fuel lines.

J. Engine mounted battery charging alternator, 40-ampere minimum and solid-state voltage regulator.

K. Coolant heater

1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

L. Provide vibration isolators, spring/pad type or as recommended by the manufacturer, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

M. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.

N. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

O. A UL listed certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. The charger may be located in an automatic transfer switch, or may be wall mounted, at the discretion of the installer. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:

Loss of AC power - red light
Low battery voltage - red light
High battery voltage - red light
Power ON - green light (no relay contact)
Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses

2.03 AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation

system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

E. Provide anti-condensation heater for the alternator.

F. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.04 GENERATOR SET CONTROL. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of

generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.

2. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
3. Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

C. Generator Set Alarm and Status Display.

1. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
   low oil pressure (alarm)
   low oil pressure (shutdown)
   oil pressure sender failure (alarm)
   low coolant temperature (alarm)
   high coolant temperature (alarm)
   high coolant temperature (shutdown)
   engine temperature sender failure (alarm)
   low coolant level (alarm or shutdown--selectable)
   fail to crank (shutdown)
   fail to start/overcrank (shutdown)
   overspeed (shutdown)
   low DC voltage (alarm)
   high DC voltage (alarm)
   weak battery (alarm)
   low fuel-daytank (alarm)
   high AC voltage (shutdown)
   low AC voltage (shutdown)
   under frequency (shutdown)
   over current (warning)
   over current (shutdown)
   short circuit (shutdown)
   over load (alarm)
   emergency stop (shutdown)
2. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control:
   engine oil pressure (psi)
   engine coolant temperature (degrees F or C)

engine oil temperature (degrees F or C)
engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator. The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
3. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of

the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
5. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
6. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a "weak battery" alarm shall be initiated.

G. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems; and in addition shall provide indications for high battery voltage, low battery voltage, loss of normal power to the charger. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

H. The generator set shall be provided with a genset mounted main circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

## 2.05 OUTDOOR SOUND ATTENUATED WEATHER-PROTECTIVE

A. The generator set shall be provided with an outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure. sheet metal shall be primed for corrosion protection and finish painted with the manufacturers'

standard color using a two step electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted.

B. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

C. The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in an ambient temperature of up to 100F. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 81 dBA at any location 7 meters from the generator set in a free field environment.

D. The enclosure shall be insulated with non-hydroscopic materials.

E. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

F. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

G. The enclosure shall include the following maintenance provisions:

1. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves.
2. External radiator fill provision.
    a. Provide an external emergency stop switch that is protected from accidental actuation.
    b. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
    c. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
    d. Integral lifting provisions.

## PART THREE - OPERATION

### 3.01 SEQUENCE OF OPERATION

A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

B. The generator set shall complete a time delay start period as programmed into the control.

C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control

system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.

2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

D. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.

E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

1. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

## PART FOUR - OTHER REQUIREMENTS

4.01 SUBMITTALS. Within 10 days after award of contract, provide six sets of the following information for review:

A. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.

B. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.

C. Manufacturer's certification of prototype testing.

D. Manufacturer's published warranty documents.

E. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

F. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

G. Manufacturer's installation instructions.

4.02 FACTORY TESTING

A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

4.03 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

4.04 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

4.05 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not

less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

4.06 SERVICE AND SUPPORT

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

4.07 WARRANTY

A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

**END OF SECTION 16112**

**SECTION 16400**

**SERVICES AND DISTRIBUTION**

## PART ONE - GENERAL

1.01 SCOPE

A. Work under this section is for the installation of underground power supply for the building.

1.02 SYSTEM VOLTAGE

A. System Voltage shall be 277/480 volts, 3 phase, 4 wire, from the Power Company pad-mounted transformer to the main service and distribution panel in the building.

## PART TWO - PRODUCTS

2.01 SERVICE CONDUIT

A. Conduit shall be PVV, encased in 3000 psi duct bank

## PART THREE - EXECUTION

3.01 Provide the underground primary and secondary conduit systems complete, including all excavation, backfill, trenching, spacers, stakes, conduit, etc., as indicated on the drawings, and as required.

3.02 Provide concrete pad for transformer in accordance with Power Company Specifications.

3.03 The Contractor shall install underground service conduit from the main panel to the Power Company transformer. Cable shall be pulled in by and connections made by Contractor.

3.04 The Contractor shall secure all permits and make all arrangements with the Power Company for the connection of electrical service to the building and coordinate metering requirements.

3.05 All equipment and service shall be grounded in strict accordance to requirements of the NEC, and local regulations. Ground rods shall be copper-clad 3/4" diameter, 10 feet long driven full length into the earth. The maximum resistance shall not exceed 25 ohms under normally dry conditions.

**END OF SECTION 16400**

## SECTION 16415

## EMERGENCY/STANDBY POWER SYSTEMS TRANSFER SWITCHES

### PART ONE -GENERAL

1.01 SCOPE

A. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product and employed by the generator set supplier shall service the transfer switches.

1.02 CODES AND STANDARDS

A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. CSA 282, Emergency Electrical Power Supply for Buildings
2. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
3. NFPA99 – Essential Electrical Systems for Health Care Facilities
4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
6. NEMA ICS10-1993 – AC Automatic Transfer Switches.

B. The transfer switch assembly shall comply with the following standards:

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN55011, Class B Radiated Emissions
3. EN55011, Class B Conducted Emissions
4. IEEE 62.41, AC Voltage Surge Immunity.
5. IEEE 62.45, AC Voltage Surge.

C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 ACCEPTABLE MANUFACTURERS

Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based transfer switches manufactured by Cummins Onan. Equipment by other suppliers that meets the requirement of this specification are acceptable, if approved not less than 2 weeks before scheduled bid date. Proposals must

include a line by line compliance statement based on this specification.

## PART TWO -PRODUCTS

### 2.01 POWER TRANSFER SWITCH

A. Ratings

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings and at the specified voltage. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

B. Construction

1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
5. Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
6. Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.
7. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

C. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

2.02 TRANSFER SWITCH CONTROL

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
2. High intensity LED lamps to indicate that the transfer switch is "not in auto" (due to control being disabled or due to bypass switch (when used) enabled or in operation) and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.
3. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
4. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
5. "RESET/LAMP TEST" push button that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool and an operator display panel.
7. Security Key Switch to allow the user to inhibit adjustments, manual operation or testing of the transfer switch unless key is in place and operated.
8. Analog AC meter display panel, to display 3-phase AC Amps, 3-phase AC Volts, Hz, KW load level, and load power factor. The display shall be color-coded, with green scale indicating normal or acceptable operating level, yellow indicating conditions nearing a fault, and red indicating operation in excess of rated conditions for the transfer switch.
9. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
   a) Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
   b) Display source status, to indicate source is connected or not connected.
   c) Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

d) The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
   i. Set nominal voltage and frequency for the transfer switch.
   ii. Adjust voltage and frequency sensor operation set points.
   iii. Set up time clock functions.
   iv. Set up load sequence functions.
   v. Enable or disable control functions in the transfer switch, including program transition.
   vi. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

e) Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

f) Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

g) Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

h) Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:
   a) Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
   b) Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
   c) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.
   d) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
   e) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.
   f) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout

over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

h) Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

3. All transfer switch sensing shall be configurable from a Windows 95, 98, or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool down) (adjustable in a range of 0-30 minutes).
6. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
7. The transfer switch shall provide a relay contact signal prior to transfer or retransfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
8. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
9. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
10. The transfer switch shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 2 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs.

C. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be Form C, for compatibility with any generator set.
2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
3. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.

2.03 ENCLOSURE

A. Enclosures shall be UL listed. The enclosure shall provide wire bend space in

compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.

B. Transfer switch equipment shall be provided in a NEMA 1 or better enclosure.

C. Enclosures shall be the NEMA type specified. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

## PART 3- OPERATION

### 3.01 OPEN TRANSITION SEQUENCE OF OPERATION

A. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

B. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
2. The transfer switch shall issue a compatible start command to the generator set, and cause the generator set to start and run at idle until it has reached normal operating temperature.
3. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
4. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
5. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.
6. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
7. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

C. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the

exercise timer program, or when manually initiated by the operator.

2. The transfer switch shall issue a compatible start command to the generator set, and cause the generator set to start and run at idle until it has reached normal operating temperature.
3. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
4. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.
5. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

## PART 4 - OTHER REQUIREMENTS

4.01 FACTORY TESTING. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

4.02 SERVICE AND SUPPORT

A. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

D. The manufacturer shall supply to the facility owner a complete set of service and maintenance software for use in properly supporting the product. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:

1. The software shall be 32 bit and shall be Windows '95, Windows '98, XP, and NT compatible.
2. The software shall use the Windows "Explorer" format, for ease of use and commonality with other software in use at the facility.
3. The software shall allow adjustment of all functions described herein via the tool; adjustment of operating levels of all protective functions; and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
4. The software shall allow simulation of fault conditions, to verify operation of all protective devices
5. The software shall include the ability to store and display data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical "strip chart" displays.
6. The software shall automatically record all control operations and adjustments

performed by any operator or software user, for tracking of changes to the control.

7. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.
8. The software shall include detailed operation and service information on the specific generator set supplied, so that no other documentation (other than schematic and wiring diagram drawings) is necessary for service of the product.
9. The software shall have been developed under strict quality control guidelines, and comply with the requirements of ISO9001 and Mil Standard 498 for software development.

E. After generator set installation, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 10 persons employed by the facility owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

**END OF SECTION 16415**

**SECTION 16500**

**LIGHTING**

## PART ONE - GENERAL

1.01 SCOPE

A. The work included under this section includes the furnishing and installation of all light fixtures.

B. All work specified in this Section shall comply with the provisions of Section 16010.

C. General Conditions, Supplementary Conditions and General Requirements shall govern the work of this Section.

1.02 SUBMITTALS

A. Manufacturer's literature describing product.

B. Shop drawings, showing elevations, sections and method of installation.

## PART TWO - PRODUCTS

2.01 Lighting fixtures shall be furnished complete with mounting accessories to suit the specific service intended. Fixtures shown in the schedule to be recessed will be complete with accessories to furnish support from the structure above and/or any other accessories required to fit the above fixtures to the ceiling construction.

2.02 Fixtures scheduled to be pendant mounted shall be complete with supports above the ceiling, stems and canopies, swivel aligners and/or other accessories necessary to suspend the fixtures at the specified height above the floor.

2.03 Fixtures scheduled to be surface mounted shall be furnished and installed employing supports above the ceiling, toggle bolts and any other accessories which are required to adequately support the fixtures.

2.04 Fluorescent fixtures in continuous rows shall be supplied with all fixture couplings, chase nipples, and/or other accessories recommended by the manufacturer for continuous row installation.

2.05 Fluorescent fixtures shall be complete with class "P" electronic ballasts designed to operate rapid start T8 Lamps. All ballasts shall conform to the following standards:

1. Ballast shall meet sound rating "A".
2. Ballast shall meet ANSI Standards.
3. Ballast shall have a minimum power factor of .98.
4. Ballast shall have less than 15% total harmonic distortion, less than 8% third harmonic distortion.
5. Ballast shall comply with EMI and RFI Limits set by the FCC (CFR 47 Part 18) for non-residential applications and not interfere with normal electrical equipment.
6. Ballast shall operate lamps at a frequency of 25 KHz or Higher with less than 2% lamp flicker.
7. Provide Two (2) Year Warranty.
8. Maintain full cathode heat during operation.

9. Ballast shall have less than 1.5 lamp current crest factor (LCCF)j.
10. Light output shall remain constant for line voltage fluctuation +-5%.
11. Accepted Manufacturers are Motorola, Advance, Magnatek, and Triad.

2.06 Lamps shall be furnished and installed in all fixtures. All incandescent lamps shall be general service inside frosted 2500 hour life, of type required. Fluorescent lamps shall be energy saving type. Refer to the light fixture schedule on the drawings for complete information. All lamps shall be Phillips, G.E., or OSRAM/Sylvania.

2.07 Exit signs shall have metal stencils, red letters with a lamp life of 50,000 hours.

2.08 Refer to drawings for Lighting Fixture Schedule and Lamps.

2.09 DIFFUSERS

A. Unless specified otherwise, all prismatic diffusers for fluorescent lighting fixtures shall be prismatic acrylic KSH K12 or approved equal with a thickness of 0.125", measured from the back side of the peak of the prism.

B. All wraparound lens shall be virgin acrylic, one-piece and injection molded.

2.10 LIGHTING FIXTURE TRIM

A. Each recessed lighting fixture shall have a trim to match the type of ceiling (plaster, exposed grid, concealed spline, exposed panel, etc.) in which it is being installed, regardless of catalog number given. Coordinate with the Architect's Reflected Ceiling plan to provide the right trim for the type of ceiling in which the fixture is to be installed.

B. Each lighting fixture recessed in a plastered ceiling of any type shall have a plaster frame.

2.11 OTHER MATERIAL

A. All other materials and accessories, not specifically described or called for, but which are required for a complete and finished installation for the work of this section shall be furnished and installed by the Contractor at no additional cost to the Owner. These materials shall be selected by the Contractor, subject to be reviewed by the Architect.

## PART THREE - EXECUTION

3.01 Carefully install all the schedule and all specified lighting fixtures in each of the areas indicated. Fixtures shall be furnished to exactly fit the type of ceiling system as scheduled for the space.

3.02 Fixture mounting details shall be checked with the ceiling details and flanges, lay-in or wet or dry ceiling mounting shall be verified before the fixtures are ordered. The Contractor shall coordinate this item. Fluorescent fixture shall be installed with (2) 12 gauge wires. Lay-in fixtures shall be installed with alignment clips and 12 gauge wires.

3.03 Each fixture shall be marked in wiring compartment with circuit number supplying fixture. Marking may be with permanent ink marker.

3.04 All flexible conduit used to connect lay-in fixtures to junction boxes shall have 2 #12 power and 1 #12 green ground wire minimum in ½" flex. All wire shall be flexible stranded.

3.05 All exit signs shall be installed so that they can be seen in all directions. They shall not be installed behind any pipe or other piece of equipment. The stems on all ceiling mounting lights shall be of such

length that the lights shall be visible.

3.06 SUPPORT OF LIGHTING FIXTURES

A. All lighting shall be supported from the building structure. The fixtures shall be supported in a manner that will insure the fixture weight being equally distributed from each support and the fixture remaining in a level position.

B. Fluorescent fixtures installed recessed in a suspended ceiling system shall be supported from the building structure with two (2) 12 gauge wires on diagonal corners of the fixture. In addition, the fixture shall be clipped to members of the ceiling suspension system.

C. Fluorescent fixtures installed in or on any ceiling other than a suspended ceiling system specifically mentioned above shall be supported with concealed steel rods. Rods shall be 1/4" diameter minimum and shall be located where recommended by the fixture manufacturer. Provide a minimum of two (2) supports for each 4' or 8' fixture chassis. Supports shall be maximum of 48" centers. For incandescent fixtures, steel hanging wire may be used by attaching the wire to fixture mounting frame.

D. Pendant mounted incandescent fixtures shall be stem supported by a fixture stud mounted in the outlet box. Suspended fluorescent fixtures shall have mounting stems located as per the manufacturer's recommendations, but in no case shall have less than two (2) stems per chassis.

3.07 FINAL

A. Protect finished installation from damage by other trades.

B. Remove rubbish and left over materials from the site.

**END OF SECTION 16500**

## SECTION 16700

## ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION

### PART ONE - GENERAL

1.01 SUMMARY

A. This section describes the Electronic Access Control and Intrusion System scope of work for the project. This section also references the responsibilities of the Systems Integration and Electrical trade contractors pertaining to products or systems, furnished by each trade, that affect this Division.

B. It is the owner's goal to implement a card access system that will allow products from various suppliers to be integrated into a unified system and to provide flexibility for expansion, maintenance, and service of the system.

1.02 SYSTEM DESCRIPTION

A. The Electronic Access Control and Intrusion System (EACIS) as provided in this Division shall be based on the Niagara$^{AX}$ Framework (or "Niagara"). Electronic Access Control and Intrusion Systems not developed on the Niagara$^{AX}$ Framework platform are unacceptable.

B. The EACIS shall be an integrated, web-based access control and alarm monitoring system that shall be accessed through a standard Web browser. The EACIS shall consist of a Network Security Controller, Door Control Modules, Supervised Alarm Input / Output Modules, access and intrusion system peripheral devices and a standard web browser.

1. A Network Security Controller (NSC) within each facility shall regulate access, maintain historical records and alarm security personnel. The NSC shall connect to the owner's local or wide area network, as shown on plans and described elsewhere in this document. Secure access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NSC shall communicate to door controllers and other monitoring alarm input/output devices provided under Division 28.
2. A Door Control Module (DCM) shall provide a physical interface for EACIS door peripherals such as card readers, door position switches, request to exit devices and output to control the door locking mechanism. The DCM shall communicate directly to the NSC through a RS485 protocol.
3. A Supervised Alarm Input / Output Module (IOM) shall provide a physical interface for EACIS alarm inputs such as motion detectors, glass break sensors, etc. and monitor outputs to control lighting panels, horns, etc. The IOM shall communicate directly to the NSC through a RS485 protocol.

C. The EACIS shall integrate seamlessly into the existing Staefa Control system utilized throughout Walton County and specified to be installed for this facility. EACIS security components shall be able to communicate with the Staefa Control system components via the LAN using the Open Building Information Xchange (oBIX) standard. The NSC shall also have the option to control Staefa Control system devices directly using the existing Lon trunk as well as store and serve the exact unit graphics currently in use by the system.

D. The EACIS shall integrate seamlessly into the IP based Camera system. The EACIS GUI interface to denote camera locations, monitor camera inputs and pass alarming and lighting control through the EACIS to the Staefa Control System.

1.03 SUBMITTAL

A. Eight copies of shop drawings of the entire EACIS shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, Network Security Controller locations, Door Control Modules, Alarm Input / Output Modules, Card Readers and a description of the communication type, media and protocol.

C. Submittal shall also include a complete point list of all input and output points connected to the EACIS. EACIS contractor shall provide necessary point lists, protocol documentation, and factory support information for systems provided in this division.

D. Submittal shall also include a copy of each of the graphics developed for the EACIS Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

E. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Division 28 contractors shall provide as-builts for their portions of work.

F. Division 17 contractors supplying products and systems, as part of their packages shall provide catalog data sheets, wiring diagrams and point lists to the Division 15900 contractor for proper coordination of work. EACIS contractor shall also include a complete point list of all points available to be integrated into the FMCS. It is the responsibility of the Division 17 Contractor to be able to provide all points for integration to the FMCS contractor in the language required by the FMCS Contractor. The Division 17 contractor shall be responsible for as-builts pertaining to overall FCMS architecture and network diagrams. All as built drawings shall also be installed into the FCMS server in a dedicated directory.

1.04 DEFINITIONS

A. Acronyms used in this specification are as follows:

- EACIS Electronic Access Control and Intrusion System
- DCM Door Control Module
- FMCS Facility Management and Control System
- IOM Input/Output Module
- LAN Local Area Network
- NSC Network Security Controller

- PICS Product Interoperability Compliance Statement
- WAN Wide Area Network

1.05 DIVISION OF WORK

A. The Division 17 contractor shall be responsible for Network Security Controller, Alarm and Display Workstations, Door Control Modules, Card Readers, Remote Input/Output Devices, controller programming, controller programming software, power wiring and Controller, Module, Reader and I/O wiring.

B. The Division 15910 contractor shall be responsible for the integrating Network Security Controller (NSC) data and alarms into an FMCS via the local or wide area network.

1.06 RELATED WORK SPECIFIED ELSEWHERE

A. Division 08, Openings, Door Hardware, Door Position Switches

B. Division 15, Mechanical:

1. Provide AHU control devices and systems
2. Provide fans, dampers and other control devices

C. Division 16, Electrical:

1. Provide disconnect switches (unless otherwise noted)
2. Power wiring and conduit (unless otherwise noted)
3. Other equipment and wiring as specified in Division 16

D. Division 15910, Facility Management and Control:

1. Provide Network Area Controllers (NAC)
2. Provide FCMS Server hardware and software
3. Software programming between NSC and NACs or FMCS Server

1.07 AGENCY AND CODE APPROVALS

A. All products of the EACIS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. FCC, Part 15, Subpart J, Class A Computing Devices

1.08 SOFTWARE LICENSE AGREEMENT

A. It is the owners express goal to implement an EACIS system that will allow access and occupancy data to integrated into a FMCS in order to provide improved energy management and security. The Owner shall be the named license holder of all software associated with any and all incremental work on the project. In addition, the Owner shall receive use of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NSC and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the

owner.

1.09 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.10 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts.

**PART 2 PRODUCTS**

2.01 GENERAL

A. The Electronic Access Control and Intrusion System shall be comprised of a stand-alone security controller, a graphical user interface, door control modules, card readers, and other remote input and output devices as specified herein.

B. Some components of the EACIS, i.e. door locks, etc. are provided by other Sections.

2.02 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a card access and intrusion system integrated to a Niagara Framework-based FMCS and an IP based surveillance system.

B. The supplied NSC shall employ component-oriented technology (COT) for representation of all data and control devices within the system. In addition, adherence to industry standards is required to assure interoperability between all system components. For each BACnet ANSI / ASHRAE™ Standard 135-2004, system, the system supplier must provide a PICS document showing the installed systems compliance level. Physical connection of BACnet devices shall be via Ethernet using BACnet/IP. BACNet MSTP shall not be acceptable as a means to integrate the EACIS with a FMCS.

C. The EACIS shall not require a dedicated PC to host the security application or system database. The supplied system must incorporate the ability to access all data using standard Web browsers for operator interface and configuration. An embedded database shall be provided at the NSC and connectivity is required for all system database parameter storage.

2.03 NETWORKS (PROVIDED BY OTHERS)

A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and oBIX for maximum flexibility for integration of EACIS with enterprise information systems and providing support for the Network Security Controller.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 100 Base-T, UTP-8 wire, category 5

3. Minimum throughput; 100 Mbps.

C. The electrical contractor shall provide all required network products (hubs, switches, cables, etc.) for a physical connection to the LAN at the NSC.

2.04 NETWORK SECURITY CONTROLLER (NSC)

A. The NSC shall be CCS iNTREO Model CCS-201 or CCS-601 or equal. No other manufacturers will be accepted. Please Contact Jeff Morrison at 770.527.1732

B. The EACIS contractor shall supply Network Security Controllers (NSC) as part of this contract.

C. The Network Security Controller shall provide the interface between the LAN or WAN and the door control modules (DCM) and remote input/output devices, and provide global supervisory access control functions over the all devices connected to the NSC. The NSC shall provide multiple user access to the system. The NSC shall support standard Web browser access via the Intranet/Internet.

D. The NSC shall be capable of executing common application control programs to provide:

1. Calendar functions
2. Scheduling
3. Event and Credential database Reporting
4. Alarm monitoring and routing
5. Time synchronization
6. Integration via BACnet, Niagara$^{AX}$ Fox, or oBIX

E. The Network Security Controller must provide the following <u>hardware</u> features as a minimum:

1. Network Security Controller - CCS-601
   a. IBM / AMCC PowerPC 440EP 524 MHz processor or equal
   b. 256MB SDRAM & 128MB NAND Flash
   c. Two (2) Ethernet ports – 10/100 Mbps
   d. One RS-485 port and One RS-232 port
   e. Battery Backed RTC (72 hour minimum)
   f. The NSC must be capable of operation over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.
   g. Optional Autodial 56 Kbps Modem slot
   h. The NSC shall support 2 access control reader ports, 6 supervised inputs, 4 digital output relays, 1 unsupervised input for cabinet tamper detection, 1 unsupervised input for external power source AC power fail and 1 unsupervised input for battery low detection.
   i. The NSC shall support fifteen (15) additional remote modules, mix and match any combination of Door Control Modules (DCM) and Input/Output Modules (IOM).

F. The Network Security Controller shall provide an integrated battery backup to provide sufficient time for an orderly system shutdown in the event of a power failure. The NSC shall provide a minimum 4 hours backup operation to the EACIS while operating on battery backed power.

G. The Network Security Controller shall be mounted in a key locked, tamper switch

protected metal enclosure with the following requirements:

1. The cabinet shall be suitable for wall mounting and contain a removable door for ease of installation.
2. The cabinet shall be suitably sized to allow installation of the controller and additional expansion modules if required.
3. A single tamper switch shall be incorporated into the door.
4. The enclosure shall include 4 mounting holes and sufficient knockouts on the top, bottom and sides.

2.05 DOOR CONTROL MODULE (DCM)

A. The DCM shall be CCS iNTREO model CCS-R2R or equal. No other manufacturers will be accepted.

B. The DCM shall support 2 access control reader ports, 4 supervised inputs, 2 digital output relays, 1 unsupervised input for cabinet tamper detection and 1 unsupervised input for external power source AC fail / battery low detection.

C. The DCM shall communicate wth the NSC via a RS-485 connection.

D. The DCM shall provide a one wire chip for unique module address to identify installed remote modules.

E. The DCM shall be capable of operation over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.

F. The DCM shall be mounted in a key locked, tamper switch protected metal enclosure with the following requirements:

1. The cabinet shall be suitable for wall mounting and contain a removable door for ease of installation.
2. The cabinet shall be suitably sized to allow installation of the controller and additional expansion modules if required.
3. A single tamper switch shall be incorporated into the door.
4. The enclosure shall include 4 mounting holes and sufficient knockouts on the top, bottom and sides.
5. The DCM shall be capable of controlling the Card Reader to provide different audible beeps for indication of either "Access granted" or "Access denied". Te Card Reader red LED shall flash red for access denied. The Card Reader green LED shall flash green for access granted and shall show solid green when there is free access.

2.06 SUPERVISED ALARM INPUT/OUTPUT MODULE (IOM)

A. The IOM shall be CCS iNTREO model CCS-RIO or equal. No other manufacturers will be accepted.

B. IOM modules shall provide inputs and outputs to monitor and control non-reader-based system points, such as door contacts, motion sensors, gate actuators, etc.

C. The IOM will support 8 supervised four-state inputs (open, closed, short and cut), 8 digital output Form C relays, 1 alarm input point for cabinet tamper detection and 1 alarm input point for external power source AC fail / battery low detection.

D. The IOM shall communicate with the NSC via the RS-485 interface.

E. The IOM shall provide 2 diagnostic LEDs for power and communication.

F. The IOM shall provide a one wire chip for unique module address to identify installed remote modules.

G. The IOM must be capable of operation over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.

2.07 CARD READER

A. Card Reader shall be 12 VDC, Wiegand interface Card Reader or an approved equal. Each reader shall offer a low profile, rugged, weatherized polycarbonate sealed enclosure. Each shall be mountable indoor or outdoor.

B. The Card only reader option shall include audible "beeps" and visual "red and green LED" indication, to provide feedback to users.

C. Reader technologies shall include a Wiegand interface and shall support the following access methods:

1. Card only reader
2. Card plus Keypad reader
3. Card or Keypad reader

D. Keypad Readers (where specified in sequence or on drawings) shall be HID Keypad Reader or approved equal. Keypads shall contain 3 columns by 4 rows containing the characters 0 through 9, the pound (#) and the star (*) sign. The keypads shall be suitable for either indoor or outdoor use.

E. The EACIS contractor shall provide readers with the following minimum requirements:

1. The reader shall be HID model Prox Pro II or equal
2. The reader shall support standard Wiegand protocol for communication to the DCM
3. The reader supply voltage must be 12 VDC with average current draw of 25 mA
4. The reader housing shall be weatherproof with fully potted electronics
5. The reader must be capable of operation over a temperature range of -22F to +150F (-30C to +65C) and a humidity range of 0 to 95% RH, non-condensing.

2.08 MOTION DETECTORS

A. Ceiling Mounted PIR: 360° FOV

1. Minimum range: 23' diameter @ 8' mounting height
2. Minimum range: 36' diameter @ 12' mounting height
3. Maximum mounting height: 12'
4. Minimum detectable walk rate: 0.5'-5'/sec
5. Indicators: Red LED
6. Operating temperatures: 32°F to 122°F
7. Honeywell model # 997 or approved equal

B. Wall Mounted Motion Sensor

1. Minimum range: 35' x 35'
2. Microwave Frequency: K-Band, 24.125 GHz
3. Pet immune to 100 lbs.

4. Zero Clearance black bug gaurd
5. Signal Processing: Intermediate, Standard
6. Minimum detectable walk rate: 0.5'-10'/sec
7. Indicators: Tri-color LED
8. Operating temperatures:14°F to 131°F
9. Honeywell model # DT-7435 Dual Tec or approved equal

C. Request-to-Exit PIR

1. Minimum range: 5.5' x 2' up to 8.4' x 15.8' depending on mounting height
2. Mounting Height: 7' to 15'
3. Pet immune to 100 lbs.
4. Adjustable relay time
5. Adjustable shutters provide precise target area
6. Door contact input
7. Reader/keypad/keyswitch input
8. Door contact input
9. Remote arming and sounder inputs
10. Monitor Door and Fail Safe/Secure modes
11. Signal Processing: RTE and Security modes
12. Minimum detectable walk rate: 0.5'-10'/sec
13. Indicators: Green (ready) LED
14. Operating temperatures:14°F to 122°F
15. Honeywell model # IS-310 w/single gang trim plate or approved equal

2.09 DOOR CONTACTS/DOOR POSITION SWITCHES

A. The door position switches shall be furnished and installed by the Division 08000 Contractor. There shall be a 18/2 wire connected from the contactor to above ceiling for connection to the Integrated Security System.

2.10 WEB BROWSER CLIENTS

A. The system shall be capable of supporting up to twenty five (25) simultaneous clients using a standard Web browser such as Internet Explorer™, Mozilla Firefox™, or equivalent.

B. The Web browser user interface shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a login failed message shall be displayed. Security using authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens shall be in the Network Security Controller (NSC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client PC are not acceptable.
3. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
4. The NSC shall allow Users to have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
   a. Modify, Input, Delete or Override common access control objects, such as doors, credentials, interlocks, schedules, and calendars.
   b. View and acknowledge alarms.
   c. Setup and execute queries on credential and event archive information.
5. The system shall provide the capability to specify a user's (as determined by the

log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

6. Graphic screens on the Web Browser user interface shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.11 INTEGRATION TO EXISTING NIAGARA$^{AX}$ FMCS SERVER

A. A Staefa Niagara$^{AX}$ based Talon server is under contract to be installed during construction at this facility. The server shall support all Network Security Controllers (NSC) connected to the customer's network whether local or remote.

B. Local or Remote connections shall be via an Ethernet LAN/WAN. The Niagara$^{AX}$ NICS statement shall be as follows

1. accept.station.in="*"
2. accept.station.out="*"
3. accept.wb.in="*"
4. accept.wb.out="*"

2.12 SYSTEM CAPACITIES

A. The EACIS system software shall support the following features and be configured for a minimum of the following:

1. 10,000 Personnel Records
2. 50,000 Buffered Transactions of System Events
3. 16 Programmable Wiegand Card Formats
4. 250 Access Levels
5. 250 Weekly Schedules
6. 32 Holidays
7. 32 Special Holidays

2.13 ACCESS CONTROL

A. Each door as noted on the plans shall be comprised of one card reader, a door position status point, a request to exit device, and a door lock control output point designator. The reader may be substituted with a keypad or keypad/reader combination.

B. The EACIS software system shall support the following modes of access:

1. Card Reader – Requires card presentation only to gain access.
2. Card Plus Keypad – Requires card presentation and entry of personal identification number to gain access.
3. Card Or Keypad – Requires either card presentation OR manual entry of card number to gain access.
4. Free Access – Does not require credential to gain access through reader. Free access will be controlled through reader assigned system schedule.
5. Manual Control - It shall be possible to control access through the door by either manual (operator) command, upon event activation or based upon time specification.

C. The system shall allow a reader to operate using the following functions:

1. Readers shall read cards while the door is in the open position.
2. The software shall allow the following door relock configurations:
   a. Unlock the door for a user definable period of time. Valid range for access unlock time shall be from 0 seconds to 1 hour.
   b. Relock the door on door open. If the door is never opened after a valid request, the system shall relock the door when the access unlock time expires.
   c. Relock the door on door closed. If the door is never closed after a valid request, the system shall relock the door when the access unlock timer expires. The system shall report a door held open alarm, if the door remains open after the access unlock and alarm sense timer expires.
3. There shall be separate timers for the operation of the door lock and the software shunting of the door switch monitor alarm point. The shunting of the door contact following the presentation of a valid access card or activation of the request to exit device shall be accomplished by software control. The use of a hardware shunt shall not be accepted. The system shall operate according to the following with the door shunt time:
   a. Door Held Open - If the door fails to close prior to the expiration of the shunt period, a "door held open" alarm shall occur at the NSC.
   b. Door Forced Open – If door position switch is armed and an intrusion occurs (door open without authorization), a "door forced open" alarm shall be annunciated.

D. The system shall allow each door to be configured to cause a variety of alarms to occur based upon activity at that door. These shall include as a minimum

1. Door forced open
2. Door held open
3. Badge does note exist
4. Badge is lost
5. Badge is disabled
6. No active schedule
7. No access right
8. Granted but not used
9. Invalid PIN number
10. Anti Passback violation
11. Door position switch supervision
12. Request to exit supervision

E. The system shall provide the ability for the user to configure a global offset to the system badge holder's PIN number. The system shall allow a person at a keypad reader to signal the system operator that they are entering the area under duress using the PIN duress value. This duress alarm should not be evident at the card reader. The access controls normally executed by the system, person is authorized for that door, at that time and that day of the week, shall still be enforced for a duress access event.

F. The system shall provide configuration options to control the card reader's Red LED, Green LED and Beeper functions during both a valid and invalid access request. The minimum configurations for these auxiliary reader outputs shall include:

1. Use access unlock time
2. Define custom time
3. Pulse output on and off for a definable period of bursts

G. Area Control Strategies

1. Manual Control – With the appropriate password level, a user shall be able to manually control all doors and control points via the browser based user interface. Control points are defined as any door strike or any other relay output point of a NSC, DCM or I/O module. All system outputs shall be overridden by initiating a mouse "right click" and selecting the command action from a list. All manual control commands shall be recorded into the Event log for viewing by any user given proper privileges to do so. Manual control for doors, or any relay output, shall allow the user to:
   a. Unlock the door/output (leaving the door strike unlocked)
   b. Pulse the output open
   c. Return the door/output to a pre-defined automatic setting.
2. The Timed Anti-Passback feature shall enable a software timer that prevents a second access at the same reader for an adjustable period of time after a cardholder has already gained access. This helps prevent multiple swipes by an individual to allow access to others through turnstile doors.

H. The system shall support time and attendance based functionality. The software shall provide the ability to designate a card reader to be used as a "clock in" or "clock out" reader. The resulting access traffic through the time and attendance reader shall be logged in a separate report. The system should allow the OWNER to manually insert records into the log to capture missed user transactions (i.e., the user forgot to swipe their badge to either clock in or clock out).

2.14 CREDENTIAL MANAGEMENT

A. It shall be the responsibility of the EACIS Contractor to enroll all personnel and badge records (Note to specifier: Depending on the product knowledge and training, the end user has the option to enroll / manage personnel records). The EACIS shall consist of equipment and devices placed at predetermined locations to ensure that only cardholders who are authorized to enter secured areas through certain doors or gates can do so.

B. The NSC shall generate and store up to 10,000 personnel records, and monitor badge/credential use throughout the facility. The credentials database shall be populated by the user, based on data that is input and captured at the time of enrollment.

C. The user shall be able to create personnel records either through the use of direct input into the personnel record or via an import feature. Each personnel record shall be tabular in design for easy navigation through the fields. The credential data screen shall allow for multiple credentials to be enrolled in an efficient manner. The user shall have the ability from the personnel record to easily:

1. Add, delete, or modify personnel data and shall consist of a minimum of the following data fields:
   a. Record ID Number (System Defined)
   b. Last Name
   c. First Name
   d. Middle Name
   e. Employee ID
   f. Tenant Designation
   g. Department Type
   h. Person Type
   i. Personal Identification Number (PIN)
2. Add, delete, or modify personnel data in up to 10 custom defined data fields.
3. Assign and manage the cardholder's facility access rights.
4. Assign badges to personnel records by selecting badges from the un-assigned list, input new badge, or enroll new badge from system reader.

5. Enable or disable the cards - the user shall be able to mark the card as enabled or disabled by selecting that control button.
6. Define expiration date - the expiration date shall be determined by date. It shall be possible to program future start and end dates for a new cardholder's access or any specific part of their access.
7. Define the card number and facility code.
8. Mark the card as lost - the user shall be able to mark the card as lost by selecting that control button. This shall disable the card, create a stored record with the associated card number and cardholder and generate an alarm on future access attempts.

D. The user shall be able to create badge records either through the use of direct input into the badge record, mass creation through badge enrollment, bulk badge creation by defining credential number range, or via an import feature. Each badge record shall be tabular in design for easy navigation through the fields. The OWNER shall have the ability from the badge record to easily:

1. Add, delete, or modify personnel data and shall consist of a minimum of the following data fields:
   a. Record ID Number (System Defined)
   b. Credential Number
   c. Facility Code
   d. Wiegand Format
   e. Status
   f. Tenant Designation
   g. Description
   h. Activation Date
   i. Expiration Date
   j. Owner
2. Remove badge from personnel record

E. In addition to manual input of credential information, the EACIS shall allow operator to input credential records from a properly structured CSV file. The import data screen shall allow for multiple credentials to be enrolled and edited in an efficient manner.

F. After a badge is created it shall be possible to assign access privileges to the personnel record. If a user also has proper authorization, access privileges can be overwritten. When an individual's access privileges are modified, that change shall be effective immediately upon completion of the change. Changes of access privileges shall affect only the modified record, and shall not require a download of the entire cardholder database.

G. The user with proper authorization shall be able to initiate the call-up of a cardholder record. This feature shall be provided via browser to assist the user in determining access rights for an employee who may have forgotten his or her badge. Utilizing a database search via the input of the cardholder's name, or other key search fields, the EACIS shall access the employee's personnel file, and containing pertinent information for identification by the user. This operation shall not restrict the operation of monitoring alarms.

H. Contractor shall provide assistance in establishing the first 'set' of 100 access cards. Contractor shall work with County personnel in establishing a card similar to the existing county ID badges with the appropriate name, logo and picture. (Picture shall be provided as a .jpeg file to the contractor by the county for use in creating these cards). All cards in the initial set shall be done at the same time and turned over to the contractor at or before the final inspection of the project.

2.15 ACCESS RIGHTS

A. Access Privileges - All cardholders shall have facility access based on privileges assigned by controlled area, time and date. For example, some badges shall only allow access to the facility on weekdays between 8:00 a.m. and 5:00 p.m., while others allow access on weekends between 1 p.m. to 5 p.m. and so on. These time zones for each day are to be pre-defined by user and shall be able to be modified quickly by authorized employees without vendor intervention. The systems shall provide the following minimum user-definable features for access privileges.

1. Description
2. Schedule
3. Tenant
4. Collection of Readers

2.16 TENANTS

A. The EACIS software shall support logical database filtering based on tenant record designations. The system shall support the creation of multiple tenant types; EACIS access based on users with specific tenant designations, and provide ability to assign tenants to personnel records, badge records, and access rights. For example, EACIS users assigned to tenant A shall only have access to personnel, badges, access rights, reports and alarms designated as tenant A data. While employing tenant methodology, the user shall have the ability to do the following:

1. Distribute credential management responsibilities to building tenants.
2. Display data based on EACIS user assigned tenant designation.
3. Add, delete, and modify personnel records, badges and access rights of same tenant data.

2.17 SYSTEM DATE / TIME

A. Time / Date - The time and date of the system shall be set by the Network Security Controller (NSC). Dates for Daylight Savings Time shall automatically take effect. Holiday schedules input by OWNER shall be capable of overriding normal schedules in effect. The system shall support the new daylight savings rules implemented in 2007.

2.18 ALARM MANAGEMENT

A. Alarm Notification and Actions

1. The NSC shall be capable of displaying and routing alarms directly from Door Controller Modules, or from Input/Output Modules. Any alarm (regardless of its origination) shall be integrated into the overall alarm management system and shall appear in all standard alarm reports, be available for user acknowledgment.
2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
   a. To alarm
   b. Return to normal
   c. To fault
3. Provide for the creation of a minimum of 255 alarm priorities to be assigned to individual alarms.
4. NSC equipment external power fail/low battery detection and network failures shall be treated as alarms and annunciated. Door Control Module (DCM) cabinet tamper and external power fail/low battery detection shall be treated as alarms

and annunciated.

B. Alarms Annunciation

1. Alarm Console message
   a. The alarm Console manages alarms on a per-point basis. Each row in the alarm console is the most recent alarm from a point. To view all the current alarms from a particular security point, the user shall double click the row.
   b. To acknowledge an alarm, the owner shall select the desired alarm and click the Acknowledge button. An alarm is cleared from the alarm console when both of the following conditions exist:
      1.) Alarm is acknowledged
      2.) The point is in a "normal" state
   c. The user shall also be able to add notes to the alarm record using the notes dialog box.
2. Email of the complete alarm message to up to eight (8) recipients. Provide the ability to route and email alarms based on:
   a. Individual Day of week
   b. Time of day range
   c. Recipient – include the ability to cc and bcc others in the organization
   d. Type of alarm – systems shall allow user to individually assign types of alarms to go to a particular recipient including:
      1.) To Off Normal
      2.) To Normal
      3.) To Alert
      4.) To Fault
   e. Graphic with flashing alarm object(s). The background color for each alarm notification level shall be customizable to allow easy identification of certain alarm types or alarm states.
   f. Sounding of an audible beep or playing an audio file on alarm initiation or return to normal.
3. The following shall be recorded by the NSC for each alarm (at a minimum):
   a. Time and date
   b. Location (building, floor, zone, office number, etc.)
   c. Equipment (reader #, IOM point #, etc.)
   d. Acknowledge time, date, and user who issued acknowledgement.
4. A log of all alarms shall be maintained by the NSC and/or an EACIS server (if configured in the system) and shall be available for review by the user.

2.19 EVENT NOTIFICATIONS AND ACTIONS LOG

A. A separate log for System Event Transactions shall be provided and available for review by the user.

B. Every System Event shall be time stamped with the time of occurrence and shall be recorded in the Event Log. Time stamping shall include the date, and be to the nearest second

C. All operator initiated actions shall be recorded in the Event Log. Each operator action event logged to Event Log shall be stamped with time of day and operator ID. The Event Log shall include all details of any change that an operator has carried out.

D. Provide and maintain an Event Log that tracks all activities performed on the NSC. Provide the ability to specify a buffer size for the log and support a minimum of 50,000 transactional system events.

2.20 APPLICATION HELP

A. The system software shall have on-line help available at any point requiring operator input. The help screen shall be accessible by clicking on the Help button located on the page in view. This help screen shall provide detailed information about every property on the screen. Examples and screen captures will be available to assist in operator comprehension.

B. The on line help shall be context sensitive and automatically direct the user to the appropriate help section based on current location within the application software.

2.21 GUIDED WIZARD SETUP

A. The system shall provide an easy to use guided wizard setup to assist the user with initial product setup. The guided setup shall step the user through hardware setup, personnel database creation, and other pertinent system administration functions. The wizard shall be available by default on initial connection to the NSC and will remain available until completed. The system shall allow the guided wizard to be manually restarted at a later time if reconfiguration is required.

2.22 APPLICATION USER PROFILES

A. Each operator shall be given a profile as part of the operator definition. Profiles consist of a group of web pages that determine the look and feel of the user interface and the functionality that is to be assigned to each operator. Standard profiles shall include as a minimum:

1. System Administrator – Shall have full control to entire application.
2. Maintenance User – Shall have access to all sections of the application but cannot access or make changes to the system administrator account.
3. Badge Operator – Shall have access to the reports and personnel sections of the application.
4. Console Operator – Shall have access to the alarm console and reports sections of the application.

B. When an operator logs out of a workstation and a new operator logs on, the profile displayed on the workstation screen shall be automatically updated to the setting for that new operator.

C. Each profile shall provide operators with the ability to perform manual operations consistent with their area (s) of responsibilities. Manual operations available to profiles shall include as a minimum:

1. Running or printing reports
2. Locking/unlocking of doors
3. Adjusting time schedules
4. Setting / resetting control outputs
5. Creating system objects including cardholders, doors, and monitoring points

D. For each manual operation by the operator, the Activity Log will automatically record the action for display by the System Administrator or other authorized user.

2.23 GRAPHICS

A. The system shall provide a graphic subsystem that allows for the creation of real time graphic displays through the addition of animations over an imported background image. The output of each graphic will display and operate in any browser workstation. Animations will be used to display real time information (point status, alarms, etc.), to control system devices (doors, outputs, etc.). Standard graphics shall include as a minimum:

1. Floor plans (shall be similar to FMCS Floor Plans)
2. Maps
3. Building views (internal and external)
4. Readers
5. Inputs
6. Outputs

B. The system shall permit the use of standard background formats including .BMP, JPEG, and .GIF. The system must have ability to upload images and store on the NSC.

C. The system shall include an editor to build run time graphics. The graphics editor shall be executed on the NSC and no 3rd party software shall be required to add/delete/modify graphics. The editor shall include tools for adding and formatting text, adding and formatting backgrounds, and creating animations. All functions are to be performed with a mouse.

D. Completed graphics may be selected from an object tree, menu, or in response to an alarm event. Upon display, the graphic will automatically poll its associated data points and refresh the data at user specified intervals.

E. All graphics will be stored on the NSC embedded web server and served up to each browser workstation upon demand.

2.24 REPORTS

A. The system shall provide standard reports for all system transactional data and the means to create custom reports. Reports shall be accessed from the navigation tree within the application. Standard reports required at a minimum shall include:

1. Access History
2. Audit History
3. Log History
4. General Activity
5. Attendance History
6. Hardware Reports

B. The system shall allow the user to review reports in a variety of methods including:

1. Display report results on screen.
2. Export results to .CSV file format
3. Export results to .PDF format.

C. The system shall allow the user to customize the .PDF report file properties. At a minimum, the user shall be able to modify the title bar image, modify font size, style, and color.

D. Depending upon the type of report being generated by the system operator, the system shall provide a listing of previously defined reports. The operator shall be able to pick an

existing report, modify an existing report or generate and save a new report.

E. The system shall allow an operator to define and save reports and the contents contained within the report. There shall be no limit to the number of user defined reports. Based upon the type of report being created, the system shall provide a pick list of items that may be included within the report. This list shall include all possible attributes defined for each report (i.e. controller, doors, personnel, etc.).

2.25 DATABASE BACKUP AND STORAGE

A. The NSC shall have the ability to backup its database.

B. Copies of the current database and, at the most recently saved database shall be stored in the NSC or on designated network PC. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The NSC database shall be stored in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is also supported.

2.26 SYSTEMS INTEGRATION

A. The EACIS shall include objects to support the integration of EACIS data to a BACNet TCP/IP based FMCS. The connection to the BACNet system shall be via an Ethernet IP as required by the NSC. At a minimum, define the following BACNet TCP/IP data points and strategies as part of the standard EACIS:

1. Door Status:
   a. Door Open and Door Closed
2. IOM data Status:
   a. Status of all Inputs
   b. Status of all Outputs
3. Location ID property assigned to the cardholder
   a. The EACIS shall provide the FMCS integrator with two pieces of information with respect to each individual reader that provides access to a physical space: Valid Access and Location ID.
      1.) The valid access property will tell the FMCS that someone has been authenticated and entered the physical space. The location ID property assigned to the cardholder, via the access right, provides the FMCS a zone identifier integer value, which represents the physical location of this individual's work area within this space. As a result, during unoccupied periods, the FMCS shall turn on only the HVAC and lighting servicing needed to bring the individual's work area to occupied conditions.
      2.) The location ID is created under the Tenant. Create a unique integer value for each location in the building. Then when you create access rights, you can make one for each location you want to assign the cardholders.

B. Video Integration – The video system shall integrate to the FCMS through the H264 protocol (cameras specified under section 17200). Provide the following standard integration functions:

1. Bi-Directional Alarming Interface
   a. Certain alarm conditions can be communicated to FCMS and be represented as standard Niagara alarms. Examples of an alarm event include loss of video alarm and video motion detection.

2. Niagara Widgets for Video Support
   a. Ability to view live video
   b. Pan / tilt / zoom camera control
3. Alarm Video Call Up - The FCMS alarm console has been modified to allow display of video surrounding a live alarm event. If an alarm has associated video, the console has a hyperlink button that when pressed, presents a pop-up dialog with the video surrounding the alarm condition can be seen on the DVRs web interface.

C. BACNet Driver - The NSC supplier shall provide a BACNet TCP/IP system communications driver. The EACIS vendor utilizing BACNet shall provide documentation of the system's BACNet interface to the FCMS and shall provide factory support at no charge during system commissioning

D. The EACIS shall include objects to support the integration of EACIS data to a SNMP based FCMS (Optional). The connection to the SNMP system shall be via an Ethernet as required by the NSC. At a minimum, define the following SNMP data points as part of the standard EACIS:

1. Door Status:
   a. Door Open and Door Closed
2. IOM data Status:
   a. Status of all Inputs
   b. Status of all outputs.

E. The NSC supplier shall provide a SNMP communications driver. The EACIS vendor utilizing SNMP shall provide documentation of the system's SNMP interface to the FCMS and shall provide factory support at no charge during system commissioning

## PART THREE - EXECUTION

### 3.01 INSTALLATION

A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated security and control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

C. Drawings of EACIS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Electrical contractor in accordance with the specifications in Divisions 26.

### 3.02 WIRING

A. All electrical control wiring to the NAC, computers and network components shall be the responsibility of the Division 26 Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All EACIS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where EACIS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.03 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Division 28 contractor at no expense to the Owner

3.04 WARRANTY ACCESS

A. The Owner shall grant to the EACIS contractor, reasonable access to the system during the warranty period. The owner shall allow the contractor to access the system from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.05 ACCEPTANCE TESTING

A. Upon completion of the installation, the EACIS contractor shall load all system software and start-up the system. The EACIS contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. When appropriate, Division 25 and 28 contractors are to coordinate the checkout of the system when interlocks between systems are present. Ensure that each Division has a representative present during the portion of system checkout that affects them.

B. The EACIS contractor shall perform tests to verify proper performance of card access and intrusion alarm strategies. Repeat tests until proper performance results. This testing shall include a point-by-point check out to validate 100% of the input and output points and each of the card access strategies, area groupings and reporting/logging.

C. Upon completion of the performance tests described above, repeat these tests, point by point in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the Division 26 contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.06 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the EACIS hardware and software has been established the Temperature Control sub-contractor shall provide on-site operator instruction to the owner's operating personnel. Operator

instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The Division 26 contractor shall provide 8 hours of instruction to the owner's designated personnel on the operation of the EACIS and describe its intended use with respect to the programmed functions specified. Operator orientation of the EACIS shall include, but not be limited to; the overall operation program, credential management, alarm management, interlocking, area control, systems integration, card access strategies, reporting and appropriate operator intervention required in responding to the System's operation.

C. The training shall be a one day session (or as specified) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.

END OF SECTION

## SECTION 16720

## FIRE ALARM AND SMOKE DETECTION SYSTEM

### PART ONE - GENERAL

1.01 SPECIFICATION INCLUDES

A. Fire alarm and smoke detection requirements for a NFPA 72 local fire alarm life safety system.

1.02 REFERENCES

A. NFPA 72 - National Fire Alarm Code

B. NFPA 101 - Life Safety Code

C. Rules and Regulations of the Safety Fire Commissioner Chapter 120-3-3

D. O.C.G.A. Title 25

E. SBCCI, Standard Fire Prevention Code

F. ADA Public Law 101-336

G. International Building Code

1.03 REGULATORY REQUIREMENTS

A. Equipment: All devices, combinations of devices, appliances, and equipment, shall be listed for the protective signaling purpose for which they are used and shall be installed in compliance with applicable codes and standards.

B. Type of System: The control panel shall be listed for power-limited applications per NEC 760 and for compliance with the National Fire Protection Association Standards NFPA 71; for Central Station, and NFPA 72; for Local, Auxiliary, Remote Station, and/or Proprietary fire protective signaling systems.

C. Type of Service: The control panel shall be listed for the applicable types of service used, i.e.; Manual Alarm, Automatic Alarm, Waterflow Alarm and/or Sprinkler Supervisory Service.

D. Type of Signaling: The control panel shall be listed for the applicable types of signaling methods used i.e.; Coded, Non-Coded, March Time and/or Digital Alarm Communicator Signaling.

E. The provisions of O.C.G.A. Chapter 25-2, or other applicable state laws, and of the applicable Chapters of the Rules and Regulations of the Georgia Safety Fire Commissioner or the Rules and Regulations of local jurisdictions regarding the requirements for certificates, licenses, permits, plan reviews, inspections, approvals, fees, etc., shall apply.

1.04 SYSTEM DESCRIPTION

A. Fire Alarm System: Provide a complete supervised, power-limited, fire detection and

evacuation system. All equipment herein specified is that of Edwards System Technology and depicts the type and quality of the equipment to be furnished. Refer to Manufacturer's Data and Drawings for further information and qualifications. Equals by Faraday and Notifier will be acceptable. All other manufacturers require 10 day prior approval to bid.

B. System Supervision: The fire protective signaling system shall be an electrically supervised system which shall monitor integrity of circuit conductors and power supplies. Performance of fire protective signaling system circuits shall be in accordance with Style 4 operation for Signaling Line Circuits, and Style Y operation for Notification Appliance Circuits.

1.05 QUALIFICATIONS

A. Manufacturer: The Manufacturer shall be a nationally recognized company specializing in smoke detection and fire alarm systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 60 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry.

B. Installer: The installation shall be supervised by an employee of the manufacturer and shall have a NICET Level III or higher certification and a State of Georgia Low-Voltage Unrestricted License.

C. The Manufacturer Installer Organization supplying final check-out, as-built drawings on cad, contractual service and testing, shall be Listed and Authorized by UL to provide services for alarm system Certification as a means of identifying compliance with applicable NFPA Standards.

1.06 SUBMITTALS

A. Submit Manufacturer product data sheets for all proposed devices and equipment.

B. The authority having jurisdiction shall be notified prior to installation of equipment or wiring. Complete information regarding the system including specifications, wiring diagrams, battery and power supply calculations, floor plans and graphics shall be submitted for approval.

C. If submittals, upon review by the Owner and/or the Owners Representative, are found not to conform with the performance, type and quality of products as well as all other requirements of these specifications; the Contractor shall be required to resubmit. Approval of the submittals by the Owner shall, in no case, relieve the Contractor of the responsibility to meet the requirements of this specification.

D. Equipment supplier shall submit CAD drawings for review showing all field wiring, device connections, battery calculation.

E. Submit copy of NICET certification, GA Low Voltage Unrestricted License, and Underwriter's Laboratories Inc. Certificate of Compliance.

1.07 PROJECT DOCUMENTATION

A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawings.

B. Record drawings shall include location of end-of-line device locations. CADD as-built drawings and disk will be furnished by the supplier of the fire alarm equipment at the completion of the project.

C. An owner's manual to include:

1. A detailed narrative description of the system inputs, evacuation signaling, ancillary functions, annunciation, intended sequence of operations, expansion capability considerations and limitations.
2. Operator instructions for basic system operations, including alarm acknowledgement, system reset, interpreting LED and LCD indications, operation of manual evacuation signaling and ancillary function controls.
3. A detailed description of routine maintenance and testing as required and recommended and as would be provided under a maintenance contract, including testing and maintenance instructions for each type of device installed. This information shall include:
   a. A listing of the individual system components that require periodic testing and maintenance.
   b. Step-by-step instructions detailing the requisite testing and maintenance procedures and the intervals at which those procedures shall be performed, for each type of device installed.
   c. A schedule that correlates the testing and maintenance procedures with the listing.

1.08 SYSTEM OPERATION

A. All work specified in this section shall comply with the provisions of Section 16000.

B. The extent of the fire alarm work included under this Section and as shown shall include, but shall not be limited to, furnishing and installation of a Life Safety System with the following sequence of operation:

1. Actuation of any alarm initiating device shall initiate the following:
   a. Cause a message to appear on the alpha/numeric read-out indicating the custom message assigned to the device in alarm.
   b. Cause all horn/strobes to sound, all visual alarms to flash continuously.
   c. Release all magnetically held smoke doors.
   d. Provide relay at each AHU unit to shut down or reroute air handling systems to prevent the recirculation of smoke and shut down each AHU unit associated with duct smoke detector.
   e. Provide the appropriate signals to a central station or local municipal fire department for fire alarm, and fire sprinkler (as required by fire code).
   f. Provide the proper alpha/numeric custom message at the remote annunciator.

## PART TWO - PRODUCTS

2.01 FIRE ALARM CONTROL PANEL / ANNUNCIATOR

A. Addressable Control Panel EST-2 Series

1. Expandable to 380 points and four NAC
2. Battery back-up as required by code
3. Auto programming with enhanced sensitivity reports
4. Built in digital communicator for connection to monitoring station. (phone line connections and monthly monitoring to be furnished by owner )

B. Remote Alpha/numeric Annunciator Panel

1. EST LSRAS-C 80character Alpha/numeric Message (custom english text) with common control functions mounting on 2-gang electrical box.
2. Power Extender Panel.
3. Minimum of four signals circuit with power supply and standby batteries.

2.02 INITIATION DEVICES

A. Manual Pull Station Signature Series Single Action Addressable

1. SIGA-270 Single action manual station
2. 279193-11 Surface back box where required to match station.

B. Addressable Signature Series Detectors

1. SIGA-PS Photoelectric sensor
2. SIGA-SB base
3. SIGA-HRS heat sensor

C. Duct Detector Housing Signature Series

1. SIGA-DH Duct detector housing
2. SIGA-PS Photoelectric Sensor
3. Sampling Tube 6261 Series (provide required length)
4. Remote Alarm LED SIGA-LED
5. Provide Detector with programmable relay for shutdown.
6. Waterflow and Tamper switch monitor (Switches furnished by others)
7. SIGA-WTM Dual input monitor module
8. SIGA-CT1 Single input monitor module

2.03 SIGNAL APPLIANCES

A. ADA Audible / Synchronized Visual Assembly EST 757-7AT. Furnish matching surface back box where required by equipment supplier.

B. ADA Synchronized Visual Appliance EST 202-7A-T strobe. Furnish matching surface back box where require by equipment supplier.

C. Weather proof horn shall be EST 757-1A-T with 757A-WB Box.

2.04 AUXILIARY DEVICES

A. Magnetic Door Holders as applicable. Furnish control relay for connection to fire system.

1. Floor mounted 1501-AQ
2. Wall Mount 1504-AQ with long catch

B. Shutdown and start up controls

1. SIGA-CR with 2A Relay
2. MR101C 10A Relay in cabinet as required

## PART THREE - EXECUTION

3.01 INSTALLATION

A. The Manufacturer shall provide on-site technical installation support. Installation of equipment and devices that pertain to other work (if applicable) shall be closely coordinated with the appropriate Subcontractors.

B. Include on-site services of a NICET certified technician as specified to provide technical installation support for panel start up, program editing, troubleshooting of the Fire Protective Signaling System Control Panel and assistance to the Installer for one complete final system checkout in accordance with the Field Quality Control section of these specifications. The Manufacturer shall also provide one training session with the Owner, or Owners Representatives, upon completion of installation for instruction of system operation.

C. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

D. All junction boxes shall be sprayed red. Wiring color code shall be maintained throughout the installation.

E. Provide and install the system in accordance with the plans and specifications, all applicable codes and the Manufacturer's recommendations. All wiring shall be installed in accordance with all applicable codes and standards. Before requesting final approval of the installation, the installing contractor shall furnish a written statement to the effect that the system has been installed in accordance with approved plans and tested in accordance with the manufacturer's specifications and the appropriate NFPA requirements.

F. A Certificate of Completion (NFPA 72) shall be prepared. Parts 1, 2 and 4 through 10 shall be completed after the system is installed and the installation wiring has been checked. Part 3 shall be completed after the operational acceptance tests have been completed. A preliminary copy shall be provided at the time operational acceptance tests are requested and a final copy along with as-built drawings and owner's manual upon request for final acceptance.

**END OF SECTION 16720**

## SECTION 16750

## STRUCTURED CABLING SYSTEM FOR VOICE AND DATA

### PART ONE – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of contract including General and Supplementary conditions and Division 1 specification Sections.

B. Bidders to this section shall review all other sections of these specifications. All items in other sections relating to this section are as bidding on this bidder as if repeated herein.

1.02 SCOPE

A. The contractor shall furnish all labor and materials and install premises telephone and data communication system as noted on the drawings and in these specifications. The contractor will furnish, install and terminate the faceplates, jacks, connection blocks, patch panels, cables, patch cords, connectors, racks, brackets, hubs, routers and all other hardware necessary to effect a functional cable plant fully compliant with that as described in these specifications and in the drawings, and to the satisfaction of the owner.

1.03 REFERENCED STANDARDS:

A. The structured cabling placed on this undertaking shall be Category 6 350MHz, Plenum-rated, "Unshielded Twisted Pair" type and conform to the requirements contained in the latest editions of the following standards:

1. TIA/EIA-568 Commercial Building Telecommunications Wiring Standard
2. TIA/EIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
3. TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
5. Supplements to EIA/TIA-568 Technical Systems Bulletins
6. NFPA-70 National Electric Code (NEC)
7. ISO/IEC 11801 Generic Cabling for Customer Premises

The most recent versions of all above specifications apply to this project. If there is conflict between applicable documents, the order above shall dictate the order of precedence in resolving the issue unless an enforceable local or national code is in effect.

B. Federal Communications Commission

C. Underwriters Laboratories

D. NFPA 101 – Life Safety Code

1.04 SYSTEM DESCRIPTION

A. Provide a system consisting of voice and data cabling and devices as described herein and as shown on the plans including all outlet devices and faceplates, terminations,

cabling, cable support, termination blocks, patch panels, equipment racks, grounding, setup, labeling, testing, certification, etc.

B. Provide a system that exceeds the requirements of the following local area network applications:

1. IEEE 802.3 (10/100/1000 MBPS Ethernet)
2. IEEE 802.5 (4/16 MBPS Token Ring Networks)
3. 350 MHz Broadband
4. 155 MBPS, 622 MBPS and 1.25 GBPS ATM
5. 100 Base VG any LAN
6. SONET
7. FDDI/CDDI
8. IBM System 3x-AS/400
9. Appletalk
10. ISDN

C. Provide Category 6 unshielded twisted pair (UTP) cable, plenum rated, for copper data cabling, factory tested to 350 MHz.

D. Provide testing and certification by the manufacturers of the equipment as an installed system that meets Category 6 standards for structured voice and data cabling systems, including the terminations and outlet devices.

E. Provide duplex fiber optic horizontal cable where indicated.

F. Provide multi-strand fiber optic cables installed in a star configuration between each wiring closet and the main wiring closet (BET – Building Entrance Termination).

1.05 SUBMITTALS:

A. Submit a material list showing quantity, manufacturer, type and description of each item being furnished. Indicate in a separate list quantity and description of all spare parts to be turned over to the Owner at the end of the project.

B. Submit original prints of the manufacturer product sheets with complete technical data for each item being provided. Circle, arrow, or provide other permanent marking on each data sheet to clearly indicate the specific product included in the submittal. Remove or crosshatch out any product on the data sheets not applicable to the project or not being submitted for review.

C. Submit physical drawings of components.

D. Submit two scaled drawings of each communications room (plan and elevation views) indicating all components including equipment racks, patch panels, termination blocks, all wiring, cable management, etc. Coordinate placement of devices with other systems that share the communications room.

E. Shop drawings not containing all the information listed above may be rejected without review.

F. Documentation of testing on all wiring and terminations as per TIA/EIA standards.

1.06 QUALITY ASSURANCE:

A. Contractor shall be required, before awarding of contract, to demonstrate to the complete satisfaction of the Architect and/or the customer that they have the necessary facilities,

ability and financial resources to execute the work in a satisfactory manner and within the time specified; that they have been in the structured cabling business for 3 years and references which will assure the Owner of his qualifications for executing the work.

B. Contractor shall submit a copy of a valid low-voltage license in the State of Georgia (Low-Voltage Telecommunications or Low-Voltage Unrestricted as issued by the State Construction Industry Licensing Board of Low-Voltage Contractors).

C. Contractor shall submit a copy of a BICSI (Building Industry Consulting Service International) certificate certified and a RCDD (Registered Communications Distributions Designer) certificate.

D. Comprehensive list of references: Attach a detailed list of references along with contact person, dates of work, mailing address, telephone numbers.

E. Before commencing work, submit data showing that the contractor / subcontractor has successfully installed low voltage systems of the same type and design as specified. Include the names, locations, and the contact names and telephone number of at least four (4) similar installations. Specify type and design for each system and furnish documentation that the system has performed satisfactorily for the preceding eighteen (18) months.

F. Before the system is accepted by the Owner, the Contractor will be required to "walk-through" the installation with the Owner and verify proper installation and conformance to specifications, drawings, and other agreed-upon, written details.

1.07 WORKMANSHIP:

A. All work shall be performed in a workmanlike manner. Architect, Engineer, and/or Owner may observe the work procedures and workmanship of the Contractor but such observation will not relieve the contractor from responsibility for performance.

## PART TWO - PRODUCTS

2.01 MANUFACTURERS:

A. The acceptable manufacturers noted shall be installed by an authorized local factory dealer/representative for that product.

B. All connectivity products both copper and fiber optic: connectors, patch panels, wire management, patch cables, enclosures, racks and labeling are to be produced by the Acceptable Manufacturer's list below:

1. Panduit
2. Hubbell
3. Ortronics
4. AMP
5. Belden

C. The structured cabling solutions must be "end-to-end" and covered under the manufacturer's warranty as a complete system. Mixed manufacturers under different warranties are not acceptable.

2.02 HORIZONTAL CABLING:

A. Provide horizontal copper data cabling with the following requirements.

1. These cables shall be Category 6 350 MHz, Plenum-rated, Unshielded Twisted Pair cable.
2. Each cable shall be placed in a "homerun" fashion from the outlet to the wiring closet for each communications outlet needed.
3. There shall be no intermediate splices or cross connects in these cables.
4. Provide testing and certification by the manufacturers of the equipment as an installed system that meets Category 6 standards for structured voice and data cabling systems, including the terminations and outlet devices.

B. The cable shall meet or exceed the requirements of the following standards:

1. TIA/EIA 568 "Commercial Building Wiring Standard," Horizontal Cable Section.
2. Proposed ANSI X3T9.5 Requirements for UTP at 350 MHz.
3. Certified Level 6 Cable under UL's LAN Cable Certification Program.
4. IEEE 802.3
5. ICEA S80-576
6. UL Subject 444
7. PUB 48007
8. TA-TS000133
9. National Electric Code - Article 800

2.03 RISER CABLING:

A. For Analog Phone Devices Backbone provide one Category 6, 350 MHz, Plenum-rated, Unshielded Twisted Pair cable from each IDF to the MDF as feeder cable for analog phone devices. Each analog phone device feeder cable should be punched down and split into four RJ11 modular ports on the network patch panels in each closet. Each port should be labeled distinctively and corresponding with the appropriate modular port in each closet. All ports meeting these specifications should be designated for analog phone devices.

B. For Network/Data Backbone provide multi-strand fiber optic plenum-rated multimode riser cabling to each IDF closet from the MDF with the following minimum requirements:

1. Glass core, 12 strand, 62.5/125 µm core/cladding; 250 µm coating; 900 µm tight buffered construction designed for indoor installation and termination; Kevlar aramid yarn strength members surrounding the cladding of each strand; riser rated jacket (CMR).
2. All fibers must be housed in rack mounted fiber enclosures.
3. All fiber shall be terminated with LC fiber connectors and certified with a db loss meter.
4. Provide 2 LC to LC fiber jumpers (at least 2 meters) for each closet requiring fiber.
5. Fiber must be installed in 1" plenum rated innerduct or interlok jacket.
6. UL Listed, Meets or exceeds FDDI standards
7. Maximum attenuation: 3.75dB/km @ 850 nm
8. Minimum bandwidth: 160 MHz•km @ 850 nm
9. Fiber proof stress: 100 kpsi

2.04 PATCH CORDS:

A. Provide Patch Cords (for use in the wiring closets) with the following specifications:

1. Category 6 Patch Cords shall be 100% factory terminated and tested.

2. Enhanced performance modular plugs with a one-piece, tangle-free latch design eliminating the need for strain-relief boots to ease moves, adds and changes.
3. Constructed with enhanced 24 AWG stranded UTP cable
4. Have an average reduction of greater than 3.5dB in near end cross talk when compared to industry standard Category 6 patch cords tested in a worst-case, 100-meter channel to the TIA/EIA Category 6 standard.
5. Available in 1,3,5,7,10,14 and 20 ft. lengths in the following disbursement ratio: 5% - 1ft., 15% - 3ft., 30% - 5ft., 30% - 7ft., 10% - 10ft., 5% - 14ft., 5% - 20ft.
6. Available in 20% White and 80% Blue colors.
7. Patch cords should be from the same manufacturer as the structured cabling solution.

2.05 WORKSTATION CABLES:

A. Provide patch cords for the workstation (from computers to wall outlet) with the following specifications:

1. Category 6 Patch Cords shall be 100% factory terminated and tested.
2. Enhanced performance modular plugs with a one-piece, tangle-free latch design eliminating the need for strain-relief boots to ease moves, adds and changes.
3. Constructed with enhanced 24 AWG stranded UTP cable.
4. Have an average reduction of greater than 3.5dB in near end cross talk when compared to industry standard Category 6 patch cords tested in a worst-case, 100-meter channel to the TIA/EIA Category 6 standard.
5. Available in 1,3,5,7,10,14 and 20 ft. lengths in the following disbursement ratio: 15% - 1ft., 15% - 3ft., 30% - 5ft., 30% - 7ft., 5% - 10ft. (only blue), 3% - 14ft. (only blue), 2% - 20ft (only blue).
6. Available in 20% White, 5% Green and 75% Blue colors.
7. Patch cords should be from the same manufacturer as the structured cabling solution.

2.06 PLYWOOD BACKBOARDS

A. If not present, provide 4'x8' plywood backboards in each communication closet, as indicated on the drawings and painted with two (2) coats of fire retardant marine gray enamel on all sides.

2.07 FIBER OPTIC TERMINATION KITS

A. Provide fiber optic termination enclosures with the following specifications:

1. 19" Standard EIA rack mountable
2. Front access to fiber strands
3. Modular design to accept various optical fiber connectors
4. LC type connector adapter panels
5. Include multiple cable entry points and a fiber optic cable routing accessory kit
6. Front mounted jumper trough for patch cable management

B. Provide sufficient quality of enclosures and adapters to terminate each riser fiber strand, plus 20% spare capacity in each termination kit

2.08 OUTLET DEVICES/FACEPLATES:

A. Provide communications outlets (jacks for data/voice) as detailed on the drawings.

B. Copper data and voice jacks

1. The jacks used shall fit properly in the outlet openings of the faceplate.
2. The jacks used shall be Category 6 compliant modular 8 pin, 8 conductor outlet jacks with insulation displacement connectors (IDC).
3. The jacks used shall be capable of supporting LAN data rates of 350 MHz.
4. The jacks used shall conform to the latest parameters set in TIA/EIA 568.
5. Outlet jacks terminate without a punch-down tool using a forward-motion termination cap.
6. The jack should use a TIA568B wiring scheme.

C. Outlet faceplate for this arrangement shall be configured in the following fashion:

1. Provide plastic faceplate that accommodates up to 4 outlets, in any combination of voice, data or fiber optic.
2. Any vacant faceplate or communication outlet position shall be reserved for future growth and should have a dust cover/blank the same color as the faceplate inserted.
3. Provide two data and two blank outlets in each faceplate where a "data" outlet is shown on the plans at student outlets.
4. Provide three data and one blank outlet in each faceplate where a "data" outlet is shown on the plans for teacher outlet and administrator outlet.
5. Provide one data outlet in the ceiling tile with the ceiling mount power outlet for each classroom.
6. All floor box faceplates should be Hubbell HBLCFB301BASE or approved equal.
7. The network outlet jacks for "future wireless" shall be terminated as RJ45 outlets and suspended above the ceiling as designated on architectural floor plans.

2.09 PATCH PANELS:

A. Provide data patch panels at each wiring closet with the following specifications:

1. Standard 19" wide EIA rack mountable
2. EIA/TIA 568A/B pinout wiring
3. EIA/TIA 568A/B Category 6, 350 MHz compliant performance
4. 48 modular ports per panel
5. Install a modular jack at each port position (48 per panel).
6. Provide sufficient ports at each equipment rack to terminate 120% of the total number of workstation data cables.

2.10 EQUIPMENT RACKS

A. Provide equipment racks bolted to the floor in each communications closet with the following specifications:

1. Steel construction that is self supported and floor mounted
2. Assembled to accommodate 19" components at 84" high
3. Modular and support copper and fiber cabling
4. Integral cable management with vertical channels, pass through holes and slots for additional cable management accessories
5. Accept removable, hinged doors
6. Meet all EIA requirements as defined in EIA-310-D

B. Provide sufficient quantity of equipment racks so that no rack has more than 150 modular ports total (all active plus all spares). Load each rack to a maximum of six (6) 24-port patch panels or three (3) 48-port patch panels.

2.11 CABLE MANAGEMENT HARDWARE

A. Provide horizontal cabling cable supports with the following specifications:

1. Designed to support Category 6 cables without compressing or kinking cables
2. Provide hooks with the proper mounting hardware to support cabling, or pre-approved equal
3. Horizontal cable tray

B. Provide wire management at each equipment rack consisting of at least the following components:

1. Horizontal cable supports and organizers on each of the equipment rack
   a. Provide a minimum of one (1) organizer per each patch panel installed in each rack
   b. Provide hinged covers for both vertical and horizontal cable management on racks
2. Provide Velcro cable tie fastening for bundles of loose cables routed along each equipment rack

## PART THREE – EXECUTION

### 3.01 INSTALLATION

A. Provide a system in accordance to these specifications, specifications of agencies listed in references and the manufacturer.

B. Install terminal blocks vertically plumb and securely fastened to the backboards. Route station cables in brackets, troughs and wireways specifically designed for Category 6 applications (e.g. "J" hooks). Fasten cables securely to prevent strain at the termination.

C. Install cables without violating the minimum bend radius (4 times the diameter of cable) recommended by the cable manufacturer.

D. Install bulk horizontal cabling that is greater than 75 cables in the cable tray.

E. Install all jacks with the conductors oriented on the top of the jack.

F. Terminate data copper cables using T568B

G. Where cable is not installed in cable tray, support all cable at a maximum of 5' intervals using the Category 6 "J" hooks specified elsewhere herein. Adhere to the manufacturer's maximum fill for the cable support hardware.

H. Maintain at least a 12" spacing from fluorescent light fixtures and other EMI/RFI noise sources.

I. Horizontal wiring:

1. Unless noted otherwise, route each horizontal voice and data cabling to the nearest wiring closet on the same floor of the building. Determine shortest routing from outlet device to communications closet prior to installation. Maximum allowable cable length from workstation outlet to wiring closet: 295 feet.
2. Terminate all horizontal UTP data cables at patch panel modular jack's IDCs in the equipment rack in each wiring closet. Terminate the cables at the ports in the patch panel in descending room number order from left to right and top to bottom in each equipment rack.

J. Riser Wiring:

1. Unless noted otherwise, route all riser cabling, unspliced, from the main distribution wiring closet (BET) to each wiring closet on each floor of the building.
2. Terminate riser fiber optic cables at ceramic LC connectors in the fiber optic termination enclosure at each wiring closet.

K. Provide 10 feet of cable slack at each communications closet to allow future reconfiguration of the closets. Provide wire management to organize the slack.

L. Coordinate placement of devices with other systems that share the communication rooms (i.e. Telephone equipment, Owner LAN equipment, etc.)

M. Secure all cable routed to the equipment rack, patch panels, punchdown blocks, etc, utilizing the cable management hardware.

N. All copper cabling that is exterior to the building at any point should be installed with lightning protection at both termination points.

3.02 HORIZONTAL CABLING IDENTIFICATION

A. Identify and label each horizontal cable (each end), outlet faceplate, patch panel port, and termination block.

B. Provide type identification labels using the following labeling scheme: W-Y-Z-X

Where:

W is the network closet number (CL1, CL2, etc.)
Y is the final School room number (100,101,etc.)
Z is a unique letter for each faceplate in the room, starting at the main door into the room, following a clockwise rotation around the room. Omit the letters I, O, and Q.
X is a sequential number for each outlet in each faceplate starting at one for the outlet at the top left of the faceplate and then counting sequentially from left to right and then top to bottom.

Example: "CL2-100-B3" identifies a cable from Closet 2 which is the third outlet in the second faceplate from the door in room 100.

C. Provide typed Patch Panel labels on the front of each port in each patch panel using the labeling scheme described above.

D. Provide self-laminating cable labels on each end of each horizontal cable using the labeling scheme described above.

3.03 RISER CABLING IDENTIFICATION

E. Identify and label each riser cable (each end) on the patch panel port.

F. Provide type identification labels using the following labeling scheme: Y-Z

Where:

Y is the final Closet number (1,2,etc.)
Z is a unique letter for each port on the panel. Omit the letters I, O, and Q.

G. Provide typed Patch Panel labels on the front of each port in each patch panel using the labeling scheme described above.

H. Identify each pair of each riser cable as described above.

3.04 COPPER CABLE TESTING

A. Test 100% of the copper cable pairs as described in bulleting EIA/TIA-568B, level IIE up to 100 MHz. Record the results of the test with the cable identification and provide as part of the as-built drawings. Any cable that fails shall be reterminated and retested. If the cable does not retest within specs after reterminating, replace and retest the cable.

B. Perform permanent link testing on all pairs. Test each cable with the patch cables and workstation cable installed. Test each cable from both ends.

3.05 FIBER OPTIC CABLE TESTING

A. Use test equipment manufactured to perform the fiber optic cable testing. The testing contractor shall be trained by the test equipment manufacturer or by the manufacturer's certified representative.

B. Prior to installation, perform a visual continuity test of each strand of each cable on the cable reels to determine whether or not the cables were damaged during shipment.

C. After the cables are installed and terminated, test each strand of each fiber optic cable using an insertion loss tester. Perform the tests with all connectors installed and terminated. Include an original hard copy output for each strand tests, as generated by the test equipment.

D. Also perform an insertion loss test for each strand of fiber optic cable. Perform the test with all connectors installed and terminated.

E. If the attenuation of the pair of connectors for each strand of fiber optic cable exceeds 0.5dB per connector (1.0 dB total per strand), replace the connectors and retest.

F. Include the insertion loss test results in the O&M manuals.

3.06 TRAINING

A. Walk the Owner through the entire system, starting with the layout of the equipment in each communications closet.

3.07 AS-BUILT DOCUMENTATION

A. Provide complete CAD as-built floorplans (AutoCad 14) that contains at least the following information:

1. Architectural floorplans with finalized school room names and numbers
2. Locations and identification of all voice, data and fiber optic outlets
3. Cable routing for all cables, including riser cables. Include a legend on the plans to readily identify the voice, data, and fiber optic cables
4. Conduit sizes and routing for all cables installed in conduit
5. Cable tray routing and locations
6. Bonding and grounding locations
7. Large scale blowup of all wiring closets, indicating elevation views and plan views of all termination blocks, equipment racks, patch panels, fiber optic kits, etc.
8. Terminal backboard layout, with labeling and pair identifications

B. Provide two (2) complete as-built manuals assembled in loose-leaf binders containing the following:

1. As-built system functional block diagrams
2. Corrected copies of approved shop drawings
3. As-built system wiring diagram
4. List indicating each device, location, address, label, etc.
5. System Maintenance manuals
6. Warranty information and 15-year certification

C. Name, address and phone number of the responsible service organization

3.08 WARRANTY

A. The Contractor shall furnish a written warranty from the manufacturer that describes the network cabling and associated equipment supplied under these specifications will be free from defects of materials and workmanship for a period of twenty-five years and the cable plant/labor will be free from defects of materials and workmanship for a period of twenty-five years from the date of final acceptance unless otherwise specified and that all defects occurring within that period shall be corrected in a timely manner at no cost to the Owner.

END OF SECTION 16750

# SECTION 16760

# INTERCOMMUNICATIONS/PROGRAM DISTRIBUTION SYSTEM

## PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Coordinate with other divisions of this specification where applicable.

1.02 CODES

A. Work covered by this section of the specifications shall conform to NFPA 70, the National Electrical Code, and latest edition.

1.03 STANDARDS FOR MATERIALS

A. All material shall be new and shall be listed by the Underwriters' Laboratories, Inc., as conforming to its standards in every case where such a standard has been established for the particular type of material in question or except as otherwise specified or implied herein.

1.04 SHOP DRAWINGS

A. Where equipment is specified herein or on drawings, by manufacturers' names or numbers, this shall denote minimum requirements as to quality, type, capacity, function and performance. All equipment must have the Engineer's approval before ordering. Submit not less than six (6) copies of submittal data on all equipment and materials. Submittals shall include a cover sheet for each piece of equipment itemizing equipment features to show compliance with or deviation from the requirements contained in the specifications and drawings.

B. Submittals shall include drawings on the system and all its components including wiring diagrams, schematics and interconnections.

C. Any equipment to be substituted must be presented to the board of education for approval a minimum of ten days before the bid date.

1.05 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The contractor shall furnish not less than three (3) copies of operating and maintenance instructions for all equipment he has furnished and installed. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

1.06 SERVICE FACILITIES

A. Contractor shall make available to the Owner a Service Department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

1.07 WARRANTY

A. One year warranty on all parts and labor shall be provided by the systems contractor. The contractor shall supply documentation which states that the manufacturer shall provide an additional four (4) year warranty on the major system components. This year warranty shall be supported by the systems contractor, verified in writing, with expiration of warranty date and notarized by a Notary Public.

1.08 INSERVICE TRAINING

A. The contractor shall provide a minimum of four hours of in service training with this system. The sessions shall be broken into segments which will facilitate the training of individuals in the operation of this system. Operators manuals and users guides shall be provided at this time.

1.09 SINGLE SOURCE RESPONSIBILITY

A. Except where specifically noted otherwise, all equipment shall be the standard product of a single manufacturer or be an associate supplier of products. The supplying contractor shall have attended the manufacturer's installation and service school. A certificate of this training shall be provided with the contract submittals.

1.10 DESCRIPTION OF SYSTEM

A. The Central/Sound/Communications Control Center shall be Rauland, offering the combined features and functions of all systems. Systems not providing these specified features will not be considered. Furnish all labor, materials, tools and equipment necessary for complete installation and checkout of the system as outlined in these specifications.

B. EQUIPMENT MANUFACTURER: Where shop drawings are submitted and marked accordingly for response, the contractor shall, in letter form, acknowledge the corrective action. A timely response of the resubmittal is strongly suggested. A lack of time to order the equipment is not an acceptable reason to install incorrect or unspecified material. Such equipment installed without reviewed and acceptable shop drawings will be removed and replaced at the contractor's expense. Specifications are based on Rauland equipment, equals by Dukane and Executone.

1.11 INTERCOM AND PUBLIC ADDRESS OPERATION

A. The administrative telephone communication system shall be a Rauland Telecenter providing at least the following features and functions:

1. The Administrative Control Center shall be a standard pushbutton dialing telephone complete with solid-state pre-tuned tone oscillators identical to those employed by the public telephone companies.
2. The Central Switching Exchange shall be a Global Switching System, that is, there shall be no linking within the system that would restrict or block telephone communications.
3. Direct dialing private two-way telephone communications between all locations equipped with administrative telephone and staff telephone shall also be provided.
4. The Central Switching Exchange shall have facilities for 16 full duplex unrestricted simultaneous private telephone conversations between administrative telephones and between administrative telephones and staff telephones.

5. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way "amplified voice" communication. The warning tone signal shall sound as soon as the station is selected, and shall be automatically repeated at regular intervals.
6. Direct-dialing, two-way "amplified voice" communications between all locations equipped with administrative telephones and staff (classroom) loudspeakers without the use of a press-to-talk or talk-listen switch.
   a. The Central Switching Exchange shall have facilities for one twelve (12) watt two-way "amplified voice" communication channel(s) with expansion to three, providing simultaneous communication on each channel from administrative telephones.
   b. Automatic Queuing shall be provided for the two-way amplified voice communication channels. A call waiting shall be automatically connected when a channel becomes available.
   c. The amplified voice communication channel shall have automatic level control on return speech to assure a constant return speech level.
7. Capacity to call staff (classroom) stations having both telephones and loudspeakers, by automatically ringing the telephone if the speaker is in use or by loudspeaker if the phone is in use.
   a. Ability to change the mode of communication during a call, i.e., change from amplified voice communications to phone-to-phone communications.
   b. During the course of a call, the conversation may be continued over the telephone by lifting the telephone handset. The conversation shall automatically be switched from the speaker the handset.
8. Capability for any administrative telephone to transfer a "call" from another administrative telephone or any staff (classroom) telephone to any other telephone.
9. Facilities for conference calls between administrative telephones and between administrative telephones and staff (classroom) telephone or loudspeaker stations. Facilities for two-way communications between any staff (classroom) telephone and any classroom loudspeaker station.
10. Provide the capability of assigning speaker locations to any one or more of eight (8) software programmable zones for zone paging or time signal reception. Through programming, it shall be possible to exclude selected speakers from the reception of paging announcements.
11. Provide for distribution program material by the "Dial-UP" method using the designated administrative station.
12. Provisions for restricting access to the Emergency Announcements, paging or tone signal origination to certain administrative telephones. This shall be accomplished by the use of an authorized administrative telephone.
   a. The system shall provide Personal Identification Numbers (PIN) for selected administrators. By dialing their PIN from any telephone, regardless of that phone's restrictions, they shall have all the capabilities of their office telephone.
   b. If a telephone which is associated with a speaker originates a "paging announcement", the speaker shall automatically be muted to prevent feedback.
13. Facilities to easily change the dial code number of any circuit. The assignment of the architectural numbers shall be accomplished by the use of any authorized administrative telephone.
14. The system shall provide facilities for independent digital readout displays upon which incoming calls are identified by their designated numbers. The display shall show visually, in the order received, three (3) calls at a time. Emergency calls shall override normal calls and shall be identified as "EMER" and the station number.
   a. Originating calls from any staff/classroom location may be directed to any or all of the twelve independent displays via programming from a designated

administrative phone.

15. It shall be possible to review all calls stored, in groups of three in order received.
16. Facilities for answering calls registered in the readout merely by pressing a single "response" button.
17. Provide an All-Cancel function from an administrative telephone to cancel all classroom annunciated calls.
18. Provide "Built-In" Master Program Clock capable of correcting various secondary clocks and sounding class change signals throughout the communication system speakers.
19. The system should have complete interconnect capabilities to central office lines. It shall be possible to transfer central office lines to any station in the system. Access to outside lines can be limited to certain authorized administrative telephones.
20. Diagnostic functions shall be provided to simplify maintenance. An RS-232C serial data port shall be provided for connection to a computer for "on site" or via a modem for to a remote computer diagnostic functions by distributor or maintenance personnel.
21. The system shall be completely compatible with the Rauland Telecenter Plus Media System. The system shall be wired to allow future DTMF telephones to be installed in classroom locations. Systems not having these capabilities shall not be accepted.
22. The entire equipment cabinet with its electronics shall be factory wired and tested in the United States.
23. The system shall include provisions for future implementation of remote control media center video equipment using future DTMF telephones to be installed in selected classrooms.
24. The system shall be equipped with one ( 1 ) telephone intercom channel, 16 communication links, one loud speaking intercom channel (capable of communicating with any classroom simultaneously with the telephone intercom channel), 1 program channel (expandable to 3), 1 channel for zone functions, (160) classroom speaker lines and (8) administrative lines.

## PART TWO - PRODUCTS

2.01 The following equipment shall be provided to fulfill the proceeding requirements.

A. EQUIPMENT CABINET - Rauland Model RP1103B. Equipment shall be contained in an upright rack of modern design, constructed of at least 16 gauge cold-rolled steel, heavily re-inforced for maximum strength and durability. It shall have a hinged and key-locking rear door providing authorized personnel with easy access to components. It shall be no more than 81" high, 22 3/8" wide, and 18 1/2" deep, with 77" total panel mounting space, designed for the installation of standard 19" professional equipment, finished in ebony black baked enamel.

1. Provide cabinet with casters.

B. CENTRAL CONTROL UNIT - Rauland Telecenter Control specifically designed for use with modern dual-tone telephones and switching networks. It shall provide two-wire balanced transmission complete with dial tone, automatic ringing and busy signal. It shall be of advanced microcomputer design, modular plug-in construction, non-volatile software, and user-programmable.

1. The control unit shall be equipped as described in these specifications.

C. CABLE TERMINATION - All cables between equipment cabinet and terminal blocks shall be equipped with "plug on" connectors for each end. The connecting blocks shall be S66M150R

and the cables shall be RICSWCABLE-15.

D. POWER AMPLIFIER - shall be solid state amplifier shall be capable of producing an audio output of 250 watts RMS. The frequency response shall be within + or -1.5db from 40-15,000Hz and the noise level shall be at least 90db below rated output. Amplifier shall require no more than 0.3 volt input signal for rated output. Regulation shall be less than 2db from no load to full load.

E. AM/FM TUNER/CASSETTE PLAYER - shall be designed for continuous duty service in institutional and industrial sound systems. It shall be completely solid state, including transistors and integrated circuitry. The AM portion shall cover the entire broadcast range of 530 to 1620 KHz. The FM section shall have a tuning range of 85.5 -108 MHz. Cassette Player shall play all standard cassettes at a tape speed of 1 7/8" per second with frequency response of 50- 14,000 Hz, with less than 0.15% wow and flutter. Signal to noise ratio shall be 50 db or better. Cassette player shall reverse automatically at the end of tape. Unit shall have a built-in front panel monitor speaker. Controls on instrument front panel shall include AM-FM button, on/off volume control, automatic search & manual tuning buttons, preset & store buttons, autostore button, clock button, tone control, balance control, fader control, fast-forward, fast-rewind, eject/reverse direction 4-position monitor/send switch. The unit shall have a back-lit digital readout display and indicate whether AM or FM, and shall indicate stereo status. It shall alternately display time.

F. ANTENNA - Harada RA-07 shall be provided with LGB grounding block, brackets and hardware.

G. MASTER CONTROL CLOCK - shall be microprocessor-based, and shall be easily programmable by the user through electronic means. A simple step-by-step guide shall be provided to enable the user to accomplish the programming quickly and correctly. Master control clocks which are not microprocessor-based and/or which require a technician or programmer to perform the initial and subsequent changes in program, at additional cost, shall not be considered.

1. This Program Clock shall be a part of the Intercom Console.

H. FUNCTIONS A:

1. Ability to operate solely as a master clock.
2. Capacity of storing 255 events and up to 16 holidays in non-volatile memory.
3. Ability to review, edit and delete events.
4. Review events from any time of day.
5. Events shall be programmable to any one or all of eight zones. (if applicable)
6. Selection of any one of four schedules.
7. Fully automatic holiday scheduling.
8. Interface with all secondary slave clocks.

I. ANALOGUE CLOCKS-SECONDARY - shall be 2460 Series twelve inch dial with black finish with the sweep second hand finished in red. Flush backbox shall be furnished for flush clocks. Furnish double dial where designated. The secondary clock shall operate on 120 VAC and be controlled by the master clock or it act as a stand alone clock. Guards shall be supplied for Gymnasium.

J. SPEAKERS - Rauland Model USO188, shall be an 8" permanent magnet cone type having viscous-damped cone and a ceramic (Indox 5) magnet weighing 5 oz. It shall have a frequency response of at least 65-17,000Hz, an 8 watt program power- handling capacity and an axial sensitivity of at least 96db at 4 feet with a 1 watt input. Voice coil shall be 3/4"

diameter with 8 ohm impedance. Flux density shall be 10,000 gauss. The speaker shall be equipped with Model T220L multi- tap transformer 1/2, 1, and 2 watts, 25V.

K. FLUSH CEILING GRILLE - Speaker ceiling grille shall be Rauland ACC1000 constructed of steel and have a white baked epoxy finish. It shall include matched hardware for mounting a standard 8" speaker. Its overall diameter shall be 12 7/8" with center perforation of 7 5/8".

L. CEILING SPEAKER BACKBOX - Model ACC1101 shall be a round one- piece backbox for flush mounting a standard 8 inch speaker. The enclosure shall be of painted, one-piece 22 gauge drawn steel and shall have applied in its interior a fire retardant resonance damping material. It shall have four perforated steel mounting brackets and four knockouts for conduit. Dimensions, 9 3/4" diameter with flange diameter of 12 2/16", mounting centers 11 1/4", depth 4 1/16".

M. SPEAKER SUPPORT BRIDGE - Rauland Model ACC1104 shall be a single piece unit constructed of 24 gauge galvanized rust- resistant cold rolled steel, 23 3/4" long and 14 1/2" wide. The unit is designed for firm support of ceiling speaker, grille, and backbox (if included).

N. SURFACE WALL SPEAKER BAFFLE - Rauland Model ACC1200 shall be of durable wood construction with modern decorator styling and have excellent acoustic quality, finished in natural blond. It shall have a full grille front and be at least 10 1/2" high, 10 1/2" wide and 6 3/16" deep with a volume of 475 cubic inches. Speaker mounting screws and wall mounting bracket shall be included.

O. SURFACE MOUNTED CEILING BAFFLE - Rauland Model ACC1004 constructed of heavy gauge CRS and shall have a white epoxy finish. It shall have a square grille opening with a separate subplate for mounting speaker baffle to the ACC1102 surface backbox. Backbox shall be 12 1/2" square by 4" deep with white epoxy finish.

P. HIGH-SECURITY DOOR STATION - Rauland Model HSS6 shall interface with the Rauland Telecenter and Director Series systems. Two-way communications shall be accomplished by the built-in speaker-microphone. A call-in momentary pushbutton switch shall be provided. The complete unit shall be vandal- proof in design and construction, protected externally by an 11 gauge stainless steel plate with brushed finish. Actuator shall be flush with face plate and completely isolated from the push-button, and movement shall be coupled through a coil spring to prevent damage. Speaker-microphone shall be protected against tampering as well as by flame or liquids. Unit shall mount in a standard two-gang electrical box.

Q. EXTERIOR TAMPERPROOF SPEAKER GRILLE - Rauland Model ACC1008 vandal proof baffle is designed for mounting a standard 8 inch speaker. It shall be constructed of a special self- aging aluminum alloy with tensile strength of 44,000 psi and shall be backed up with a heavy gauge cold rolled steel perforated screen to protect speaker. Each unit shall include tamperproof hardware to prevent entry into interior. It shall be finished in textured white baked enamel and have overall dimensions of 10 3/4" square by 3/4" projection. Provide Misco weatherproof speaker assembly and back box.

R. CALL STATION - Rauland Model 2304FA, call origination switch shall be mounted on a stainless steel plate and require one momentary depressing of the button to activate a "call in".

S. BUS CALL TELEPHONES - Rauland Model TC4300 series shall be desk or wall type high quality touch dial telephone, dual-tone instrument, complete with call buzzer, 5 1/2' retractable cord with plug. It shall conform to public utility specifications. The dial pad shall be a standard 12 pushbutton type with solid-state pretuned oscillators. The instrument housing and handset

shall be of high impact plastic, finished in ivory color. Funish in heavy duty flush box with locking door BLS-1.

T. ADMINISTRATIVE MASTER - Rauland Model TC4204 shall be a desk type high quality touch dial telephone, dual-tone instrument suitable for desk use or wall mounting, complete with call buzzer, 5 1/2' retractable cord with plug. It shall conform to public utility specifications. The dial shall be a standard 12 pushbutton type with solid-state pretuned oscillators. The instrument housing and handset shall be of high impact plastic, finished in ivory color. Furnish desk or wall type stations as required.

U. LCD DESK DISPLAY - Rauland Model TC4221 shall display up to four, three digit station numbers simultaneously; the first three shall be registered calls and the forth shall indicate the last number called. An audible tone shall be provided and the display shall be equipped with a dip switch for selecting its own addressable code to allow routing calls to it independently of other displays.

V. UPS POWER SUPPLY - Provide uninterrupted power supply/line conditioner for the Telecenter Control Model PRA1500.

W. Cable shall be supplied by systems contractor.

| | |
|---|---|
| Room Speaker | WP25357 |
| Telephone | WP25357 |
| Call Station | WP25220 |
| Corridor & Exterior Speaker | WP25292 |

2.02 INSTRUCTION

A. The system supplier shall provide a minimum of four hours instruction time for the user. The time shall be preset and coordinated by the architect and owner.

2.03 CERTIFICATION

A. The system supplier's representative shall be on hand for final hook-up and test, and shall certify, in writing, that the system is fully operational and meets the requirements of this section.

**END OF SECTION 16760**

**SECTION 16770**

**GYMNASIUM SOUND SYSTEM**

## PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. CODES: Work covered by this section of the specifications shall conform to NFPA 70, the National Electrical Code, 2008 edition.

1.02 STANDARDS FOR MATERIALS

A. All material shall be new and shall be listed by the Underwriters' Laboratories, Inc., as conforming to its standards in every case where such a standard has been established for the particular type of material in question or except as otherwise specified or implied herein.

B. Submittals shall include a cover sheet for each piece of equipment itemizing equipment features to show compliance with or deviation from the requirements contained in the specifications and drawings.

C. Submittals shall include drawings on the system and all its components including wiring diagrams, schematics and interconnections.

1.03 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The contractor shall furnish not less than two (2) copies of operating and maintenance instructions for all equipment he has furnished and installed. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

B. Furnish all labor, materials, tools and equipment necessary for complete installation and checkout of the system as outlined in these specifications.

1.04 SERVICE FACILITIES

A. Contractor shall make available to the Owner a Service Department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

1.05 WARRANTY

A. The contractor shall provide one (1) year warranty on all parts and labor for the equipment.

B. Additional **four (4) year factory backed warranty** shall be provided on all amplifier parts.

C. Factory documentation shall be provided for this warranty.

## PART 2 - PRODUCTS

2.01 Refer to drawings for equipment type.

## PART THREE - EXECUTION

3.01 The installer shall check the following:

A. Check the speaker line for correct impedance: the load shall not be larger than the amplifier output.

B. The contractor shall guarantee all equipment including parts and labor for a period of one year. The manufacturer's warranty on parts shall be extended an additional four (4) years which shall be verified by factory documentation.

C. The systems shall be demonstrated to the proper authorities and a letter of certification from the authorized supplier stating that the systems are operating as herein specified shall be forwarded to the owner.

**END OF SECTION 16770**

**SECTION 16771**

**CAFETERIA SOUND SYSTEM**

## PART ONE - GENERAL

1.01 RELATED DOCUMENTS

A. CODES: Work covered by this section of the specifications shall conform to NFPA 70, the National Electrical Code, 2008 edition.

1.02 STANDARDS FOR MATERIALS

A. All material shall be new and shall be listed by the Underwriters' Laboratories, Inc., as conforming to its standards in every case where such a standard has been established for the particular type of material in question or except as otherwise specified or implied herein.

B. Submittals shall include a cover sheet for each piece of equipment itemizing equipment features to show compliance with or deviation from the requirements contained in the specifications and drawings.

C. Submittals shall include drawings on the system and all its components including wiring diagrams, schematics and interconnections.

1.03 OPERATION AND MAINTENANCE INSTRUCTIONS

A. The contractor shall furnish not less than two (2) copies of operating and maintenance instructions for all equipment he has furnished and installed. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

B. Furnish all labor, materials, tools and equipment necessary for complete installation and checkout of the system as outlined in these specifications.

1.04 SERVICE FACILITIES

A. Contractor shall make available to the Owner a Service Department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

1.05 WARRANTY

A. The contractor shall provide one (1) year warranty on all parts and labor for the equipment.

B. An additional **four (4) year factory backed warranty** shall be provided on all amplifier parts.

C. Factory documentation shall be provided for this warranty.

## PART TWO - PRODUCTS

2.01 Refer to drawings for equipment type.

## PART THREE - EXECUTION

3.01 The installer shall check the following:

A. Check the speaker line for correct impedance: the load shall not be larger than the amplifier output.

B. The contractor shall guarantee all equipment including parts and labor for a period of one year. The manufacturer's warranty on parts shall be extended an additional four (4) years which shall be verified by factory documentation.

C. The systems shall be demonstrated to the proper authorities and a letter of certification from the authorized supplier stating that the systems are operating as herein specified shall be forwarded to the owner.

**END OF SECTION 16771**

**SECTION 16772**

**TIME OUT ROOM MONITOR SYSTEM**

## PART ONE - GENERAL

1.01 SCOPE

A. Furnish all equipment necessary for a complete and operable intercom system as outlined in these specifications.

B. SERVICE FACILITIES: Contractor shall make available to the owner a service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

C. SHOP DRAWINGS: Submit shop drawings on the system and all its components including wiring diagrams, schematics and interconnections.

D. MANUALS: The manufacturer shall furnish a minimum of three complete sets of operating instructions and a service maintenance manual. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

E. EQUIPMENT: The equipment specified is based on equipment as manufactured and furnished by Rauland, Dukane, or Executone.

1.02 FEATURES & FUNCTIONS

A. The Communications system shall provide at least the following features and functions:

1. Direct 1-way voice monitoring to the classroom from the time out room VIA electric microphone.
2. Two-way communication between the classroom and the timeout room VIA a talk-listen "push to talk" assembly.
3. A power "on-off" switch and listen volume control shall be provided.

## PART TWO - EQUIPMENT

2.01 AMPLIFIERS - shall be flush mounted as shown with the power supply and relay assembly. The amplifiers have inputs with phantom power for microphones. The amplifier cabinet shall have locking door to access microphone controls and power switch.

2.02 MICROPHONES - shall be Model RIC202BR condenser type having a hemispherical polar pattern and frequency response of 50- 20,000 Hz. Microphones shall be flush ceiling mounted in security grade baffle.

2.03 CLASSROOM CONTROL STATION - Rauland Model HSS-1-POW-VC stainless steel security grade, puncture proof with speaker, volume control and power on-off. It shall be flush mounted as shown on the drawings.

2.04 TIMEOUT ROOM SPEAKER - shall be Rauland HSS2 security grade constructed of stainless steel, puncture proof provided with impedance matched speaker. The unit shall be flush ceiling mounted as shown. The backbox shall be provide with 3 gang ring.

2.05 CABLE - Speaker cable WP25292
Microphone cable WP25292

## PART THREE - EXECUTION

3.01 CONNECTING SYSTEM

A. Check each speaker line for correct impedance: the load shall not be larger than the amplifier output.

3.02 CERTIFICATION

A. The system supplier's authorized representative shall be on hand for final hook-up and test, and shall certify, in writing, that the system is fully operational and meets the requirements of this section.

**END OF SECTION 16772**

**SECTION 16775**

**MEDIA CENTER SOUND SYSTEM**

## PART ONE - GENERAL

1.01 Furnish all labor, materials, tools and equipment necessary for complete installation and checkout of the system as outlined in these specifications.

1.02 SERVICE FACILITIES

A. Contractor shall make available to the owner service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts.

1.03 MANUALS

A. The manufacturer shall furnish a minimum of three (3) complete sets of operating instructions and a service maintenance manual. This shall include internal schematics and wiring diagrams, detailed to allow a technician to install, operate, maintain, calibrate and repair the equipment.

1.04 FEATURES AND FUNCTIONS

A. The Sound System shall provide at least the following features and functions:

B. Provide microphone pickup at outlet locations designated on the drawings.

C. Provide auxiliary input for future program sources.

D. Provide input for the school wide intercommunication system.

E. The amplifier shall be rack mounted in the television distribution cabinet.

## PART 2 – PRODUCTS

2.01 Refer to drawing for equipment types.

## PART 3 - EXECUTION

3.01 CONNECTING SYSTEM

A. Check each speaker line for correct impedance and short circuits. The load shall not be greater than the amplifier output.

3.02 CERTIFICATION

A. The system supplier's representative shall be on hand for final hook-up and test, and shall certify, in writing, that the system is fully operational and meets the requirements of this section.

**END OF SECTION 16775**

**SECTION 16850**

**IP VIDEO CCTV**

## PART ONE – GENERAL

1.01 SECTION INCLUDES

A. Video surveillance system, including the following:

1. Computer software and hardware, cameras, controls, wiring and piping required to perform the functions, intent and performance required.
2. Devices required for proper system operation including any special electrical switches, transformers, disconnect switches, circuit breaker protection, etc., required for proper and continuous electrical operation of the system.

1.02 RELATED SECTIONS

A. Section 17100 - Electronic Access Control and Intrusion System (EACIS): IP Cameras shall integrate seamlessly with the specified EACIS system. It is the responsibility of this contractor to provide all drivers and/or interfaces to complete a fully functioning integrated security solution.

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

B. Federal Communications Commission (FCC):

1. FCC CFR 47 part 15 class A - Telecommunications - Radio Frequency Devices - Digital Device Emission.

C. International Electrotechnical Commission (IEC):

1. IEC 60529 Degrees of protection provided by enclosures (IP Code).
2. IEC 60950 Information Technology Equipment - Safety.

D. Institute Of Electrical And Electronics Engineers, Inc. (IEEE):

1. IEEE 802.3af Power over Ethernet.

E. International Organization for Standardization (ISO):
1. 9001 - Quality System.

F. Underwriters Laboratories, 1nc. (UL):

1. UL 50 Enclosures for Electrical Equipment.
2. UL 2043 Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.
3. UL 60950-1 Information Technology Equipment - Safety.

1.04 DEFINITIONS

A. IP Camera: Conventional analog camera with an embedded encoder that directly generates IP video stream.

B. Encoders and Decoders: Devices that transmit video, audio and camera control data to IP cameras via IP network such as Ethernet LAN, WAN or internet.

C. IP Video Management System: Video surveillance system that enables users to view video via both a PC and analog monitors. Comprises a PC based host, video management software, IP cameras, IP network switch and storage units.

D. ISCSI: Refers to protocol, a standardized way to talk to IP-based storage across an IP network.

1.05 SUBMITTALS

A. Submit under provisions of section 01300.

B. Product Data: Manufacturer's data, user and installation manuals for all equipment and software programs including computer equipment and other equipment required for complete video management system, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:

1. Detailed wiring diagrams and system description.
2. System device locations on architectural floor plans.
3. Full Schematic of system, including wiring information for all devices.

D. Closeout Submittals:

1. User manual.
2. Parts list.
3. System device locations on architectural floor plans.
4. Wiring and connection diagram.
5. Maintenance required and maintenance schedule.

1.06 QUALITY ASSURANCE

A. Contractor Qualification:

1. Installing contractor shall have minimum 3 years experience working with the iNTREO Security Solution – See Specification Section 17100. Cameras shall be seamlessly integrated into this system.

B. Manufacturer Qualification:

1. Minimum of ten years experience in manufacture and design of access control, surveillance and security systems and devices.
2. Provide availability of equipment for expansions, replacements, and spare parts available to dealers or end users.
3. Provide factory direct technical support from 8:00 a.m. to 8:00 p.m. via phone and e-mail, or 24/7 via Web.

4. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard.

C. Installer Qualification:

1. Minimum of five years experience installing access control, surveillance and security systems and devices.

D. System Requirements:

1. Listed by UL specifically for the required loads.
2. Listed by EN specifically for the required loads.
3. Listed by FCC specifically for the required loads.
4. Listed by RoHS specifically for the electronic assembly.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers; and unharmed original identification labels.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect store materials from environmental and temperature conditions following manufacturer's instructions.

D. Handle and operate products and systems according to manufacturer's instructions.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. Provide manufacturer's warranty covering three year for CCTV products for replacement and repair of defective equipment.

**PART TWO - PRODUCTS**

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Axis Communications Network Cameras: Installed by Control Concepts, Inc. Contact Jeff Morrison 770.527.1732

B. No other manufacturer's shall be accepted and/or reviewed.

2.02 IP BASED CAMERA SYSTEM

A. General Characteristics:

1. An IP based camera system based on four types of interchangeable modules: camera, housing, communications and power supply.
   a. Camera Module includes fixed or PTZ, color or Day/Night and zoom range options.
   b. Housing Module is available for indoor and outdoor applications.

c. Communications Module determines how video and data will be communicated to the IP video system.
d. Power supply module options meet site specific installation requirements (indoor or outdoor) and protection against unexpected surges in power.

2. Allow hot swap capability (change modules without having to power down the system).
3. Camera Dome Bubble:
   a. Meet flame, crush, and impact resistant requirements able to exceed UL 746C standard for polymeric material enclosures.
   b. Rugged bubble available made of 2.6 mm (7/64 inch) thick polycarbonate able to withstand a 100 foot-pound (138 kg-meters) impact or the equivalent of a 10 lb (5.5 Kg) sledgehammer dropped from a height of 10 feet (3 m).
   c. Provide a clear or tinted version as scheduled.
4. Camera housing designed in-ceiling, or indoor/outdoor pendant versions.
5. Camera dome designed in wall mount, roof (parapet) mount, mast (pole) mount, corner mount, pipe mount, and in-ceiling versions. The pendant camera system is a Type 4X (NEMA 4X) and IP66 certified, rugged, weather-resistant package.

B. Interior Hallways

1. Product: Fixed dome network Camera as manufactured by Axis Communications. P3301 or approved equal.
2. Camera shall be manufactured with a tamper-resistant casing.
3. The camera shall be equipped with a 10BASE-T/100BASE-TX Ethernet-port and shall include support for Power over Ethernet according to IEEE 802.3af
4. Minimum Video Streaming: Multi-stream H.264 and Motion JPEG: 3 simultaneous individually configured streams in max. Resolution at 30 fps; more streams if identical or limited in frame rate/resolution. Controllable frame rate and bandwidth
5. Lens: Varifocal 2.8-10mm, F1.3, DC-iris; Angle of view, horizontal: 23"-72"
6. Image sensor: 1.4" Progressive Scan RGB VGA CMOS
7. Minimum illumination: 1 lux, F1.3
8. Shutter time: 1/20000 s to ¼ s
9. Resolution: 160x120 to 640x480
10. Frame Rate: (H.264 & JPEG) 30 fps in all resolutions
11. Security Protection: Password protected, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log.
12. Alarms: The camera shall be equipped with one digital (alarm) input and one digital output, and shall be able to trigger its embedded event functionality based on alarm input, camera tampering alarm, or detection of video motion. The camera shall be equipped with at least 64 MB of memory for local storage of images.
13. Camera shall be equipped with built-in web server and supported by an open and published API.

C. Short Interior Hallways and Stairways

1. Product: Fixed dome network Camera as manufactured by Axis Communications. M3301 or approved equal.
2. Camera shall be manufactured with a tamper-resistant casing.
3. The camera shall be equipped with a 10BASE-T/100BASE-TX Ethernet-port and shall include support for Power over Ethernet according to IEEE 802.3af
4. Minimum Video Streaming: Multi-stream H.264 and Motion JPEG: 3 simultaneous individually configured streams in max. Resolution at 30 fps; more

streams if identical or limited in frame rate/resolution. Controllable frame rate and bandwidth

5. Lens: 3.0 mm, F2.0, fixed Iris; Angle of view, horizontal: 66°
6. Image sensor: 1.4" Progressive Scan RGB VGA CMOS
7. Minimum illumination: 1 lux, F2.0
8. Shutter time: 1/5000 s to ¼ s
9. Resolution: 160x120 to 640x480
10. Frame Rate: (H.264 & JPEG) 30 fps in all resolutions
11. Security Protection: Password protected, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log.
12. Alarms: The camera shall be equipped with one digital (alarm) input and one digital output, and shall be able to trigger its embedded event functionality based on alarm input, camera tampering alarm, or detection of video motion. The camera shall be equipped with at least 64 MB of memory for local storage of images.
13. Camera shall be equipped with built-in web server and supported by an open and published API.

D. Exterior

1. Product: Network Camera as manufactured by Axis Communications. P1311 or approved equal with appropriate housing for installation
2. Casing: Metal (Zinc).
3. Light Sensitivity: 0.6 – 30000lux, F1.2
4. The camera shall be equipped with a 10BASE-T/100BASE-TX Ethernet-port and shall include support for Power over Ethernet according to IEEE 802.3af
5. Minimum Video Streaming: Multi-stream H.264 and Motion JPEG: 3 simultaneous individually configured streams in max. Resolution at 30 fps; more streams if identical or limited in frame rate/resolution. Controllable frame rate and bandwidth
6. Lens: 4.0 mm, F1.2, fixed Iris; Angle of view, horizontal: 42°, CS Mount
7. Image sensor: 1.4" Progressive Scan RGB VGA CMOS
8. Minimum illumination: 1 lux, F2.0
9. Shutter time: 1/5000 s to ¼ s
10. Resolution: 160x120 to 640x480
11. Frame Rate: (H.264 & JPEG) 30 fps in all resolutions
12. Security Protection: Password protected, IP address filtering, HTTPS encryption, IEEE 802.1X network access control, digest authentication, user access log.
13. Alarms: The camera shall be equipped with one digital (alarm) input and one digital output, and shall be able to trigger its embedded event functionality based on alarm input, camera tampering alarm, or detection of video motion. The camera shall be equipped with at least 64 MB of memory for local storage of images.
14. Camera shall be equipped with built-in web server and supported by an open and published API.

E. Communications Infrastructure: Provided by Owner

F. Power Supply Modules:

1. Certifications from UL, CE, NEMA-rated.
2. Operating Temperature: -60 degree to 50 degree C (-76 degree F to 122 degree F).
3. Humidity: 0% to 100%, condensing.
4. Color: white.

2.03 DIGITAL RECORDING AND STORAGE: Shall be by owner. Division 17200 shall coordinate with owner all connections for communication backbone.

2.04 COMMUNICATION BACKBONE:

A. This contractor shall be responsible to furnish and install plenum rated CAT 5e or CAT 6 cable and appropriate connections for each camera location and terminated in the MDF room as directed by owner.

B. Length of run for each cable shall not exceed 320'

2.05 VIDEO INTEGRATION TO SECURITY SOLUTION

A. The video stream shall be captured and displayed using the H.264 encoding format. Integration to the Security Solution shall be by this contractor and shall allow for GUI interface to each camera and motion detection for alarm reporting and annunciation.

1. It is the responsibility of this contractor to provide any links inside the security solution GUI for individual viewing of each camera without exiting out of the Floor Plan Graphic. Multiple cameras shall be capable of being viewed through pop-up windows through this graphic. All interface requirements for this functionality shall be provided by this contractor.

**PART THREE - EXECUTION**

3.01 EXAMINATION

A. Examine areas to receive devices and notify adverse conditions affecting installation or subsequent operation.

B. Do not begin installation until unacceptable conditions are corrected.

C. If preparation is the responsibility of another installer, notify architect of unsatisfactory preparation before proceeding.

D. Ensure selected location is secure and offers protection from accidental damage.

E. Location shall provide reasonable temperature and humidity conditions, free from sources of electrical and electromagnetic interference.

F. Final location shall ensure power source is protected against accidental shutoff.

3.02 INSTALLATION

A. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.

B. Install necessary wiring in accordance with manufacturer's recommendations and this document.

C. All wiring shall be installed in accordance with NFPA 70, the national electrical code.

D. Installation contractor shall provide complete wiring diagrams to the electrical contractor as part of the shop drawing submittal, and shall supervise the installation in order to insure a complete operating and trouble-free system.

E. Provide sets of keys for all panels, stations and devices.

3.03 FIELD QUALITY CONTROL

A. Installation contractor shall submit a written test report that the system has been 100% tested and approved. Final test shall be witnessed by the owner, engineer, electrical contractor, chief security officer, and performed by the installation contractor. Final test report shall be received and acknowledged by the owner prior to request for final payment.

B. Provide instruction to the owner's satisfaction with regard to proper use and operation of the system.

C. Determine and report all problems to the manufacturer's customer service department.

3.04 ADJUSTING

A. Final adjustment of camera FOV shall be per direction of owner. Contractor to coordinate this prior to finalization of project.

3.05 DEMONSTRATION

A. Demonstrate at final inspection that surveillance system and devices functions properly.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

END OF SECTION